SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. L.—No. 18. [NEW SERIES.] | NEW YORK, MAY 3, 1884. | $3.20 per Annum. [POSTAGE PREPAID.]

PLAN TO INCREASE THE WATER SUPPLY OF NEW YORK.

In 1774, when New York city had a population of 22,000, Christopher Colles built a reservoir on the east side of Broadway about one and one-half miles from the Battery, and sunk a well on the bank of the Collect. This was the first attempt to supply the city with water, and its completion was prevented by the Revolution. Twenty-five years later the Manhattan Company built a well near the Collect, 25 feet in diameter and 30 feet deep; from this water was pumped by two steam engines of 18 horse power each into a reservoir on Chambers Street. The distributing pipes were bored logs, 25 miles of which had been laid in 1823, supplying some 2,000 houses in addition to manufactories. In 1830–32, the same company sunk a well, corner of Broadway and Bleecker Street, 8 inches in diameter and 442 feet deep; a 6 horse power engine got 44,000 gallons daily. During the same year the city built for the Fire Department a well on Thirteenth Street near Broadway, 16 feet in diameter, and 112 feet deep, nearly 100 feet of which was through rock. Twelve feet from the bottom two galleries, each 4 by 6 feet, were run out for a distance of 75 feet; a branch 25 feet long was extended from one of these. The water rose to a height of 50 feet above tide, and was pumped by a 12 horse power engine into an iron tank 20 feet high by 44 feet across, and placed at an elevation of 84 feet above tide. There was laid in connection with the reservoir a line of 12-inch cast iron pipe to William Street, with 6 and 10-inch branches—a total of 34,700 feet. The pipe cost $70,950, and in January, 1833, the works had cost $42,233.

At that time the supply was so small that some 600 hogsheads of water were brought in daily from the country and sold for about $1.25 each. In 1834, the Thirteenth Street well was increased 100 feet in depth by a 2½ inch bore, which added 20,000 gallons to the daily supply. Water was also forced into the reservoir from a well near Jefferson Market, 30 feet deep and 16 feet diameter. Eighty thousand feet of cast iron pipe had been laid from the reservoir for the use of the Fire Department up to 1835 at a total cost of $182,852.

A plan to take water from Croton River was adopted by the Common Council in 1835. Across the river was built a dam having an overfall of 90 feet long in masonry, the balance being earth embankment. This was washed away by a freshet early in 1841, and when reconstructed the overfall was made 180 feet in length. In 1866–72 a dam 78 feet high from the rock foundation, 670 feet long on top, and 8⅔ feet wide, was built for a storage reservoir at a point 23 miles from Croton dam. Another storage dam was built on the middle branch of the Croton in 1874–78. Plans are now being carried out for a dam at Kensico, on the Bronx River, for another storage reservoir. The total capacity of the storage is 9,000,000 gallons.

(Continued on page 277.)

VIEW SHOWING THE CONTEMPLATED QUAKER DAM ACROSS CROTON RIVER—NEW YORK WATER SUPPLY.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, MAY 3, 1884.

REMOVAL.

The SCIENTIFIC AMERICAN Office is now located at 361 Broadway, cor. Franklin St.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 435,

For the Week ending May 3, 1884.

Price 10 cents. For sale by all newsdealers

THE INTERNATIONAL PATENT UNION.

A commercial treaty between the United States and several of the prominent European nations is now before the Senate for ratification, which, if adopted with appropriate legislation, will confer valuable privileges upon American inventors, and relieve them from certain annoying difficulties to which they are at present subjected.

The new treaty establishes in effect an international patent union, which provides that the citizens of each nationality who register an application for a patent in their own country shall have the prior right to register a corresponding application, during a period of six months, in all of the countries belonging to the Union, with one additional month to countries beyond the sea, the United States for example. Under the existing laws the American patentee is subject to various perplexities.

If he should simultaneously apply for patents at home and in foreign countries, several of the foreign patents would be issued prior to the home patent, owing to the delays in the Washington office; and such prior issues would reduce the term of the American patent down to the term of the shortest foreign grant. Most of the foreign patents are granted for 14 years, but some of them are granted only for 5 years with privilege of renewal; and thus the American patent becomes reduced to 5 years, as the renewal privilege counts nothing with our law makers. Furthermore, if the invention is granted abroad before it is issued here, the dates of the foreign patent must be given under oath to our Patent Office and appear in the American patent, otherwise the American patent, it is supposed, is rendered invalid. Again, if the American patent is granted before the foreign applications for patents are made, the inventor is thereby debarred from obtaining patents in the principal European countries.

The American patentee is in the habit of meeting some of the difficulties by withholding his applications for foreign patents until after his American patent has been passed upon and allowed by the Washington office; then, before the actual issue of the home patent, he files his applications for foreign patents, taking care, however, that no foreign patent issues until after the American patent comes out.

If the new treaty is ratified, our patent laws should also be amended so as to sweep away all the above vexations and enable the inventor to obtain and hold foreign patents without detriment to his home patent.

Eleven States have already signed the Union, namely: France, Belgium, Italy, Spain, Portugal, Switzerland, Netherlands, Servia, Brazil, Guatemala, Salvador. The first four countries are the only ones of present importance—as no patents are granted in Switzerland or Netherlands, and few in Brazil, Guatemala or Salvador—to American inventors. If the treaty is ratified by the Senate, as seems probable, the United States then enters the Union, and we presume Great Britain and Germany will follow.

The treaty applies not only to patents, but to industrial drawings, trade marks, and other industrial property. It contains provisions for the establishment of a sort of clearing house, or international bureau of the Union, which is to be under the charge of the Swiss Government, and which shall have such prerogatives as the members of the Union shall determine.

STATUS OF THE CONGRESSIONAL PATENT BILLS.

We have much pleasure in stating that in the Senate, last week, on motion of Senator McPherson, of New Jersey, the hostile patent bills were all recommitted to the Committee on Patents for further consideration. The motion was adopted without a dissenting voice.

This very gratifying result is due to the prompt and efficient action of the many friends of the patent laws and home industries, who for several weeks past have taken upon themselves, individually, the trouble to send remonstrances to their Senators, in the form of letters and petitions, giving multitudinous and substantial reasons against the passage of the bills. The press, also, has greatly assisted in the enlightenment of members of Congress by presenting in the strongest aspect the advantages of the patent system, and the ruinous results to be expected from the proposed legislation, if carried out.

The great speech of Senator Platt, with its array of statisties and convincing logic, has had a most satisfactory influence. As it now stands, so far as the Senate is concerned, the matter is indefinitely postponed; and the floods of new light that have been furnished to the members render it doubtful whether any law adverse to the encouragement of industry and invention will be again brought forward during this session.

In the House, so far as we can learn, there has been a decided modification of views on the part of many members. At the outset of the campaign against patents it was a prevailing belief that a great deal of fraud was being carried on in different parts of the country, under cover of the patent laws, whereby many "innocent purchasers" were being victimized; and it appears to have been this belief which gave rise to that sudden impulse of hostile feeling under which the two obnoxious bills were rushed through the House.

Having been for many years in constant, close communication with inventors, patentees, manufacturers, and men of progress in all parts of the country, we felt we could not be mistaken in believing that members of the House had been imposed upon; and we declared the statement that "innocent purchasers" were generally suffering wrongs, to be without real foundation. We invited the members to call out and produce all possible proofs of this suffering among their constituents; for if it existed it ought to be known and promptly remedied. We asked the people everywhere to write to their members and give the true facts; and if they wanted the patent laws to be nullified to say so.

Many thousands of letters have accordingly been sent to Washington, but we believe they all tell only one story, namely, that the almost unanimous feeling everywhere except in a small part of Indiana, is that *nobody is suffering, but everybody is benefited by the patent laws.*

In some parts of Indiana, where there is considerable water underground, the patent drive well is extensively used.

More than 5,000 wells are said to have been put down in one county, on which the patentees have demanded their usual royalty of $5 a well; users of these wells save from fifty to a hundred dollars per well by means of the patent; they cannot be hired to stop the use, but still refuse to pay the patent fee; and when summoned to appear as infringers, they cry out about fraudulent patents.

Another band of "innocent purchasers" are makers and users of barbed wire fencing, who object to pay a few cents per rod as royalty for a patent fence, that saves them a thousand dollars a mile clear cash for every mile of fencing they put up. Members of the House, we believe, are beginning to find out that the rank and file of suffering innocents for whom their sympathies have been invoked consists only of a lot of infringers, who squeal because they are not allowed to take the patent property of other people without payment.

HINTS TO INVENTORS.

It is the close observer, not only of present but future wants, who makes the successful inventor. The world is one huge kaleidoscope, and its views and requirements are ever changing. What is good to-day will prove insufficient to-morrow, hence improvement is but a natural sequence of the present, and he who takes Time by the forelock is the one who wins; nor is this constant change to be wondered at, for the world is progressive, and there is no human device but has some defect, so that the cry is ever for something better or cheaper. There are few inventions in advance of the times, but thousands to meet the wants of the present, and not a few behind the age. These are no idle aphorisms, but genuine truths, and it would be well for inventors generally to remember and profit by them.

There are other things, too, that it would be well to remember. As it is in time of peace that we should prepare for war, so is it during the current season that inventors should provide for the next. Now is the time, as the summer solstice approaches, when improvements suitable for that and the following seasons should be taken in hand, be matured, perfected, and patented. Experiments are necessary, and these take time, as do also the securing of letters patent and the necessary business arrangements to have all things ready and the supply on hand when the demand comes. For lack of thus moving in time, many an inventor has found himself unprepared to introduce his invention to the public during the season it is adapted to, and had to wait an entire year till the like season comes round again before he could do so, and then it has proved too late, as a superior, or even inferior, but better pushed improvement has got the foothold and superseded it. There are many trades in which the greatest activity prevails during the season in which there are no sales and none expected. Summer prepares for winter, and so should it be with the inventor.

So much for the time when inventions should be made, perfected, and secured. What to invent is the next, or perhaps the first, thing to consider. There are men of such versatile genius that scarcely any subject or device is too hard for them to improve upon, but, as a general rule, those are the most successful who devote their attention to subjects and things more immediately connected with their own calling in life, for they know from experience what are the practical defects of the present state of things and what is actually needed. Thus the farmer is better acquainted with agricultural machines, and the carpenter and machinist with the tools of their trade, and any improvements which such may make, in their own line, are generally meritorious and valuable.

Another hint, and we have done. Most inventors overestimate the pecuniary value of their inventions. They want too big a price for that which comparatively cost but little, hence they fail to profit by their patents. There are few patents of any merit but will sell at a price and pay a thousand times better than any ordinary investment. True, fortunes have been made out of patents, and fortunes are still being so made, but that is no reason why every inventor should be so liberally rewarded. A fair recompense is surer.

The Fastest Passage.

The new Guion steamship Oregon has just beaten all previous records, her actual time between the two points above mentioned being 6 days 10 hours and 10 minutes. Her best day's run during the voyage was 472 miles, and her poorest 440. Her average was over 450 miles a day, or nearly 19 miles an hour. According to the log of the Oregon, she traveled in all 2,861 miles. This is 100 miles more than was made by the Alaska on her quickest voyage. The days' runs of the Oregon were as follows: April 14, 440 miles; 15, 460; 16, 455; 17, 470; 18, 469; and 19, 472.

ASPECTS OF THE PLANETS FOR MAY.

VENUS

is evening star. She takes the lead among her brethren, not only for being fairest, brightest, and largest of the stars, but also for the occurrence of one of the four great epochs in her course.

On the 2d, at 5 o'clock in the evening, she reaches her greatest eastern elongation, when she is 45° 33' east of the sun. Not a second farther can she go. The invisible chain that binds her to the sun has reached its limit. The fair planet then rests from her labors, and stands still in her course as if conscious of her surpassing loveliness, and willing that observers on this planet should have a chance to admire the fascinating grace of her presence. But she remains not long inactive. She turns her course westward and approaches the sun, or retrogrades, at a more rapid pace than she receded from him. Any intelligent observer can see this, for her westward movement or approach to the sun is easily traced from night to night as she threads her way among the stars. This she will do until she reaches inferior conjunction in July, when, passing between us and the sun, she reappears on his western side as morning star, and will be seen no more in the evening sky for 292 days.

The apparent course of Venus as viewed from the earth is as follows: From superior conjunction she moves in a straight line eastward from the sun till eastern elongation—her aspect on the 2d—and approaches him till inferior conjunction. The process is then reversed. She moves in a straight line westward from the sun to western elongation, and completes the circuit by approaching him till superior conjunction. She is then hidden in his dazzling rays, to emerge again as evening star, and recommence the same series of oscillations till another synodic period of 584 days is completed.

This is her apparent course. Her real course is a revolution around the sun in an almost circular orbit from west to east and at an almost uniform rate of speed.

The reason her apparent path in the heavens differs so much from her real path is easily explained. The earth, from which she is viewed, is moving in her orbit with a velocity of 18 miles a second. Venus is moving in a smaller orbit with a velocity of 21 miles a second. The result of these complicated movements is that Venus, to an observer on the earth, moves in straight lines east and west of the sun and follows closely in his steps. As Venus appears to terrestrial observers, so the earth appears to Martian observers, oscillating east and west in the same way, and sometimes like Venus making a transit over the sun's disk.

Venus will be the loveliest star in the heavens during the month. She will be an object of peerless beauty as, after elongation, she turns her steps westward, moves rapidly toward us, and shines benignantly in the glowing west, scarcely heeding the presence of the departing sun. The fairest of the stars is now a delightful planetary study for the naked eye and for the telescope. Observed in the telescope at elongation or a few days after, half her disk is illumined like the moon at her last quarter. Soon after, she takes on the form of the waning crescent, growing "fine by degrees and beautifully less" with every reappearance. Venus in crescent form near inferior conjunction is a beautiful telescopic object. Her high northern declination adds greatly to the brilliance of her present appearance.

The beautiful planet is especially interesting on account of the striking resemblance she bears to the earth. In size, density, position, the possession of an atmosphere, the time of her rotation, the length of her seasons, the form of her orbit, the amount of light and heat she receives from the sun, she is more like the earth than any other member of the solar system. She is our nearest planetary neighbor, and, if only a moon were following in her track, Venus and the earth would be the twin sisters of the sun's family. Indeed, the planets seem to be linked in pairs. Jupiter and Saturn are the giants of the system. Neptune and Uranus follow in their train, and Mars and Mercury complete the roll.

The right ascension of Venus on the 1st is 5 h. 48 m.; her declination is 26° 45' north; and her diameter is 23·6".

Venus sets on the 1st a few minutes before 11 o'clock in the evening; on the 31st she sets at half past 10 o'clock.

NEPTUNE

is evening star until the 10th, when, leaving his brethren behind, he crosses to the sun's western side, and becomes morning star. This event occurs on the 10th, at 10 o'clock in the evening, and is called his conjunction with the sun. It is as important an event in his course as the eastern elongation of Venus is in hers. Neptune is then at his farthest point from the earth, and nearest to the sun. He is "joined" to him, as the word conjunction means rising and setting at the same time, and as completely hidden in the sun's rays as he was from terrestrial observers before his discovery in 1846.

On some accounts, Neptune will be a pleasant planet to dwell in, when, in the progress of ages, he becomes fit for the abode of animate life. All the other known planets are inferior or inner as viewed from his domain, and move in straight lines east and west of the sun, as Venus and Mercury move in our sky. But if the Neptunians have eyes like ours, they are at such an immense distance that only Uranus, Saturn, Jupiter, and perhaps Mars will be visible. Their best telescopes will hardly pick up the earth, and our beautiful Venus and fleet-footed Mercury will be forever unknown. All the planets will make transits, but at such long intervals that Uranus, the nearest neighbor, makes one only once in 40,000 years. The sun is no larger than Venus when largest, and is but a brilliant day star.

Planets beyond our ken may shine in the Neptunian sky, and astronomers there have a broad base line, thirty times as large as ours, for measuring the distance of the fixed stars. The temptation to a change of planets is not alluring. The earth with her glorious sun, her solitary moon, the six brother planets visible to the unaided eye, her favorable position in the system, and her perfection of physical development, affords all the conditions that can be desired, and the inhabitants of this fair planet are so well contented that they seldom desire to leave it.

The right ascension of Neptune on the 1st is 3 h. 14 m.; his declination is 16° 13' north; and his diameter is 2·5".

Neptune sets on the 1st about half-past 7 o'clock in the evening; on the 31st he rises about half past 3 o'clock in the morning.

MARS

is evening star, and contributes two incidents to enliven the planetary routine during the month. On the 5th, at midnight, Mars is in quadrature with the sun, following Neptune, Saturn, and Jupiter, and preceding Uranus in arriving at this point in his course. He then takes his turn in looking down from the meridian at 6 o'clock, and setting at midnight.

On the 31st, at 11 o'clock in the morning, Mars is in conjunction with Regulus, or Alpha Leonis, the bright star in the handle of the Sickle, the planet being 58 minutes north of the star. The conjunction or nearest approach of the bright actors in the celestial drama will not be visible, but planet and star will be near together on the evening of the 30th, and will be found to have passed each other on the evening of the 31st. The conjunction of a planet and a bright star is always interesting, and so is their gradual approach, which may be observed during the month.

Mars is the red planet east of Jupiter, and Regulus the bright star east of Mars.

The right ascension of Mars is now 9 h. 9 m.; his declination is 18° 32' north; and his diameter is 8".

Mars sets on the 1st at half-past 1 o'clock in the morning; on the 31st he sets a few minutes after midnight.

JUPITER

is evening star, and takes no active part in the events of the month, contented with looking his best, as with stately step he descends slowly toward the west and draws nearer, like the other superior planets, to conjunction with the sun. Jupiter is near enough to Venus during the month to bring out the fine contrast in coloring and brilliancy between the two planets.

The right ascension of Jupiter on the 1st is 7 h. 57 m.; his declination is 21° 20' north; and his diameter is 34·2".

Jupiter sets on the 1st about a half an hour after midnight; on the 31st he sets a few minutes before 11 o'clock in the evening.

SATURN

is evening star, and, like Jupiter, contributes nothing to the incidents of the month. He moves serenely on his way, surrounded by a bright galaxy of stars, and disappears at an early hour in the evening from the starlit conclave that has been the scene of his beaming presence during the long winter nights. He makes his bow to his terrestrial audience at the close of the month, for he is then too near the sun to be visible.

The right ascension of Saturn on the 1st is 4 h. 32 m.; his declination is 20° 25' north, and his diameter is 15·8".

Saturn sets on the 1st a few minutes after 9 o'clock in the evening; on the 31st he sets at half past 7 o'clock.

MERCURY

is evening star until the 17th, when he joins Neptune in deserting the ranks of the evening stars. On the 17th, at 5 o'clock in the afternoon, Mercury is in inferior conjunction with the sun. He is then between us and the sun, and, passing to his western side, becomes morning star. He is visible for the first few days of the month as evening star in the vicinity of the Pleiades, but after that time is of little importance on the monthly record.

The right ascension of Mercury on the 1st is 3 h. 50 m.; his declination is 22° 43' north; and his diameter is 10·2".

Mercury sets on the 1st about half past 8 o'clock in the evening; on the 31st he rises a few minutes before 4 o'clock in the morning.

URANUS

is evening star, and plods on his slow course in the constellation of Virgo, far removed from his brother planets at present, though some of them will overtake and pass him in the course of the year.

The right ascension of Uranus on the first is 11 h. 40 m.; his declination is 2° 57' north; and his diameter 3·7".

Uranus sets on the 1st at 10 minutes after 3 o'clock in the morning; on the 31st he sets a few minutes after 1 o'clock.

THE MOON.

The May moon fulls on the 9th at 7 minutes after 11 o'clock in the evening, standard time. On the 2d, the day of her first quarter, she is in conjunction with Mars, and on the 5th with Uranus. She then keeps clear of the planets until the 23d, the day before her change, when she passes near Neptune. On the 24th, a few hours before new moon, a beautiful phenomenon occurs. At 37 minutes past 1 o'clock in the morning, the moon is in close conjunction with Mercury, passing one minute north. Moon and planet are then below the horizon and invisible. If they were only above the horizon, and were not too near the sun to be seen, the waning moon diminished to a slender thread of silver light, and the sparkling planet almost touching her bright limb, would form a lovely picture. In some localities lying between the limiting parallels of 36° north and 25° south latitude Mercury is occulted by the moon.

The waning moon, after paying her respects to the morning stars Neptune and Mercury in the eastern sky, reappears in the western as the new moon one never tires of seeing. On the 25th she is in conjunction with Saturn, the first planet in her pathway. On the 27th she is at her nearest point to Venus, but as she is 8° 7' south, the conjunction will hardly be noticed. On the 28th she is at her nearest point to Jupiter, and on the 30th to Mars. The conjunctions with Saturn, Venus, Jupiter, and Mars occur between new moon and the first quarter, and show how near these planets are together and the order of their distance from the sun.

Copyrights for Photographs.

In the case of Sarony *vs.* Burrow Giles Lith. Co., the Supreme Court of the United States holds that in certain cases photographs are to be regarded as art works, and copyrights therefor will be sustained.

The original suit was commenced by an action at law in which Sarony was plaintiff and the lithographic company was defendant, the plaintiff charging the defendant with violating his copyright in regard to a photograph, the title of which is "Oscar Wilde, No. 18." A jury being waived, the court made a finding of facts on which a judgment in favor of the plaintiff was rendered for the sum of $600 for the plates and 85,000 copies sold and exposed to sale, and $10 for copies found in his possession, as penalties under section 4,965 of the Revised Statutes.

Among the finding of facts made by the court the following presents the principal question raised by the assignment of errors in the case:

3. That the plaintiff, about the month of January, 1882, under an agreement with Oscar Wilde, became and was the author, inventor, designer, and proprietor of the photograph in suit, the title of which is "Oscar Wilde, No. 18," being the number used to designate this particular photograph and of the negative thereof; that the same is a useful, new, harmonious, characteristic, and graceful picture, and that said plaintiff made the same at his place of business in said city of New York, and within the United States, entirely from his own original mental conception, to which he gave visible form by posing the said Oscar Wilde in front of the camera, selecting and arranging the costume, draperies, and other various accessories in said photograph, arranging the subject so as to present graceful outlines, arranging and disposing the light and shade, suggesting and evoking the desired expression, and from such disposition, arrangement, or representation, made entirely by the plaintiff, he produced the picture in suit, Exhibit A, April 14, 1882, and that the terms "author," "inventor," and "designer," as used in the art of photography and in the complaint, mean the person who so produced the photograph.

Other findings leave no doubt that plaintiff had taken all the steps required by the act of Congress to obtain copyright of this photograph, and section 4,952 names photographs among other things for which the author, inventor, or designer may obtain copyright which is to secure him the sole privilege of reprinting, publishing, copying, and vending the same. That defendant is liable under that section and section 4,965 there can be no question, if those sections are valid as they relate to photographs.

The findings, we think, show this photograph to be an original work of art, the product of plaintiff's intellectual invention, of which plaintiff is the author, and of a class of inventions for which the Constitution intended that Congress should secure to him the exclusive right to use, publish, and sell, as it has done by section 4,952 of the Revised Statutes.

Manganese in Marble.

M. Dieulafait has shown that manganese in the state of bicarbonate exists in the waters of all seas and oceans; and M. Berthelot has pointed out that in contact with oxygen, this bicarbonate becomes bioxide. It follows that oxides of manganese must be produced in large quantity in the ocean, and sinking by their weight must accumulate on the ocean bed. This corollary explains the existence of the large quantities of bioxide of manganese concretions and manganiferous mud found in the sea bed. It also explains the existence of manganese in the French and English chalks of the secondary period; also the fact recently discovered by M. Dieulafait, that the well known artistic marbles of Carara, Paros, and the Pyrenees are comparatively rich in manganese. There are two kinds of Carara marble: the ordinary, which has a bluish tinge on fracture, and the statuary marble, which is very pure and white. The well known chemical reaction showed manganese in both kinds. Parian marble, which has larger grains than Carara, also showed manganese in even greater proportion than the Carara; and the Pyrenean marbles, which resemble the Carara in being of two qualities, also contain manganese in about the same proportion. The agreement in proportion seems to indicate a similarity of cause for the presence of the manganese.

THE *Lancet* informs a correspondent that "the possibility, nay the certainty in many cases, of flies being a medium of infection, especially in warm climates, has been repeatedly pointed out, though perhaps the fact is not sufficiently borne in mind."

A NEW FIRE ESCAPE.

The balconies below the windows of the several stories of the building are constructed so as to lie in a fixed horizontal position or to fold up against the wall of the building. The ladder connecting the several balconies with each other and with the ground, for the escape of the occupants of the building, is arranged in a casing set up along the ends of the balconies. The front or door of the casing is made in sections of about the height of the respective stories, and each section is furnished with a spring latch to lock upon a catch of a rod supported along one side of the case. The latches are so constructed as to be automatically locked on the rod when the doors are closed, and to be unlatched by a vertical movement of the rod, which has an arm projecting toward each balcony. By this means the rod may be lifted from either balcony, and will simultaneously unlatch all the doors, permitting access to the ladder from any part of the building. A single door, provided with several latches, all of which catch upon the bar, may be used. The ladder can be used without the balconies, the arms being operated from the window of any story. This plan makes a fire escape which is always in place, and which can be quickly and easily operated from any story in the building.

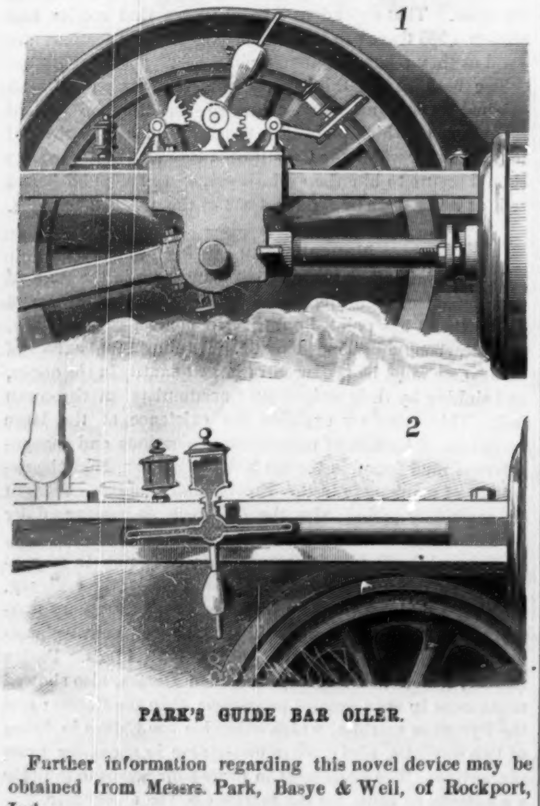
This invention has been patented by Mr. Robert Stevenson, of Muskegon, and further particulars may be obtained from Mr. Charles Stroebe, of Ferrysburg, Mich.

STEVENSON'S FIRE ESCAPE.

GUIDE BAR OILER.

The accompanying engraving represents an invention, lately patented by Mr. John S. Park, for oiling the cross head guides of steam engines, and also the guides of other reciprocating parts of machinery. Held to the cross head is a base plate, to which are secured three standards. To the center standard is pivoted a head having projecting side pieces furnished with gear teeth, and having a central stem carrying a weight which may be held at any desired height by a set screw. On each side port is pivoted an arm carrying at one end a segment plate having teeth meshing with those of the head, and at the outer downwardly bent part of the arm is a plate, to the under side of which is secured a wiper made of any suitable soft material. This distributes over the face of the guide the oil fed to it from an oil cup carried on the back of the plate. The gears are so intermeshed that a rocking motion of the weighted stem will raise one of the oiling heads from and lower the opposite one to the guide bar.

At the end of each stroke the inertia of the weighted stem, combined with the motion of the cross head, shifts the oilers, so that one of them will always be in advance of the cross head. Not only is the upper face of the guide kept oiled, but it is also kept free from dust or grit, which would, if not removed, unduly wear the surfaces. The same principle of rocking the opposite oiling heads into contact with the guide bars is shown in Figure 2. A four-armed head, made hollow to carry oil from the cup to the oiling heads, is pivoted to each side of the cross head. The operation of this will be plainly understood from the cut.



PARK'S GUIDE BAR OILER.

Further information regarding this novel device may be obtained from Messrs. Park, Basye & Weil, of Rockport, Ind.

OF the 27,672,048 inhabitants of France, 1,109,090 are foreigners, of whom 432,265 are from Belgium, 240,733 from Italy, 81,986 from Germany, 73,781 from Spain, 66,281 from Switzerland, and 37,066 from the British Isles. The number of naturalized persons is but 77,046.

Fireproofing of Wood.

Several preparations exist which render wood impervious to heat, and also increase its durability. Some of these solutions have been tested on a large scale, and have proved a success. Although these measures are cheap and their success demonstrated, they have, with few exceptions—as, for example, at Frankfort-on-the-Main, the Hof Theater at Berlin—not being employed. Perhaps constructors of theaters will, in view of these frequently occurring catastrophes, at last comprehend that even the incombustibility of the woodwork would be of inestimable value in securing immunity from fire in theaters, and that the spreading of flames would be greatly retarded when, instead of burning rapidly, as dry wood will, it slowly, without flames, chars into coal. The nature of wood makes it an easy matter to change it into what an exultant chemist has called a "fireproof" substance. On account of its porosity a solution applied to its surface sinks deeply into its pores, thereby attaining a firm hold, and on account of its rigidity exposes the covering to abrasion only. Care should be taken, where such solutions have been used, to replenish them from time to time, so as to keep the wood entirely covered. It may be well to state here what is meant by "fireproof." As this term is usually used, it signifies the property of remaining intact in high temperatures such as are produced by the conflagration of buildings; but this is not the state impregnated wood or scenery is in. These are destroyed when in contact with a flame; not, however, by burning, but by charring. If we hold a piece of impregnated scenery in the flame of a Bunsen burner, we will find that the part which was in contact with the flame has been destroyed, that is, it has been charred without producing flames or injuring the parts not in direct contact with the gas flame.

In experimenting on the impregnation of wood, canvas, and gauzes, I was particularly careful to use only chemicals as they appear in commerce, and undistilled water. In my opinion one of the chief causes of failure in methods in practice which were successful in experiment, is that the chemicals employed in experimenting were the pure reagents of the analytical chemist, while those used in practice contain many impurities which must necessarily alter the results arrived at by purer supplies.

One of the oldest and best known processes is the coating of woodwork by water glass (sodium tetra-silicate), which for a short time gives good results, but soon the covering drops off. The reason for this is that a covering of water glass is as brittle as ordinary glass, and is readily cracked and broken; and secondly, as it dries very rapidly, it does not enter any distance into the pores of the wood, but rests on the surface. Any jar or abrasive action will, therefore, cause the water glass to drop off in small chips. Another objection to this substance is its solubility. It cannot be employed in places exposed to the action of water.

Another process is to paint wood with a solution of three parts of alum and one part of sulphate of iron; after the wood has received two or three coats of this solution, it is thoroughly dried; then a solution of potter's clay and sulphate of iron, having the consistency of paint, is daubed on the prepared wood until all pores are filled, and a thin layer remains on the surface. It is claimed that in this process the alum and sulphate of iron enter deeply into the fibers of the wood, and form indestructible compounds with the chemical elements of the fibers, which cling tightly to them and cannot, as in the case of water glass, be readily washed out. The covering of clay greatly protects the wood from moisture, so that the first solution cannot be washed out or thrown out by the action of frost. This sounds well, but in practice would be too complicated.

Another objection which makes it valueless for theaters is that the clay on the surface comes off very readily in the form of dust, and, therefore, must frequently be renewed; it is also an unclean process; an actor unconsciously leaning against a piece of wood thus prepared would afterward appear before the audience with a stripe of clay dust on his back.

The following is also a complicated process: The wood is painted with hot glue water until all pores are filled, the number of coats depending on the porosity of the wood used. Then applying to the surface, before the glue dries, a powder consisting of one part of sulphur, one of ocher (or clay), and six parts of sulphate of iron. Care should be taken to powder and mix these substances well before applying them. This process labors under the same difficulty as the preceding one described.

A clean and excellent coating for wood is asbestos paint, or better still, the thicker asbestos concrete. These substances act like true paint, adhere tightly to the wood, give good protection against high temperatures, and do not readily rub or chip off. It has but one objection, that is, its solubility in water; it cannot be used in places exposed to the action of water, but for interior theater purposes this is no material objection. Great care must be taken in purchasing this article, and it should always be tested before being used, as much of the so-called "asbestos paint" which is sold is entirely worthless.—*C. John Hexamer, in the Spectator.*

Our Patent Laws and Foreign Manufacturers.

A Philadelphia manufacturer writes us that, in 1882, he sold out his business in England, and has since been manufacturing here, selling his goods to American consumers at lower figures than they were formerly imported for. He came to this country on account of the better protection afforded by our patent laws, and is the owner of many widely used patented inventions, while also engaged on further labor-saving devices in connection with woolen, worsted, and silk spinning; but he says he shall most certainly decline to make known here in what any of these improvements consist, should there be any danger of Congress so changing the law that the public might immediately rob him of the fruits of his labor.

HEAD FOR BARRELS, CASKS, ETC.

An elliptical opening is formed in the head of the cask, in which fits a flanged curb held in place by screws; between the curb and head is inserted packing in order to form an air tight joint. A flanged plate of about the same form and external size as the curb fits within the curb, and is furnished with a central screw bolt by which it is held in place in the curb by means of a cross piece through which the bolt passes. Packing is placed between the plate and curb. Upon the upper edge of the curb is placed a flat, elliptical ring which serves as a chafe plate for the ends of the cross piece to rest upon, and also makes a nice finish to the head. The construction and arrangement of the several parts will be readily understood from the engraving.

To open the cask it is only necessary to remove the nut from the upper end of the bolt, when the cross piece may be removed and the plate taken out of the cask by passing it endwise through the curb. The cask may be very easily opened and closed without removing the head, and can be closed perfectly airtight; the parts are strong and durable, and can be cheaply made.

MORAN'S HEAD FOR BARRELS, CASKS, ETC.

Additional particulars may be obtained from the inventor, Mr. Patrick Moran, of 443 Water Street, Bridgeport, Conn.

EXPERIMENTS made with gases upon insects proved the Colorado beetle hardest of all. It took prussic acid vapor to kill it outright, and was paralyzed in illuminating gas.

A Japanese Engineer.

T. A. Matsdaira, the new City Engineer of Bradford, Pa., is a native of Japan, and the first man of his nationality to be chosen to a civil office in the United States. He is the son of a wealthy Japanese nobleman, and came to this country in 1870 to be educated, not at the expense of his government, but at the individual expense of his father, who planned to have his son return home and be appointed to a high position under the Japanese Government. Upon being graduated he asked consent to remain a few years longer to practice civil engineering. His father replied that unless he came home on the next steamer his allowance would cease, and he need expect no more help from him. The son replied that he would stay, and the father became angry and wrote to his Japanese friends to have nothing to do with the young man. He staid and practiced his profession, acting for some time as assistant engineer of the Manhattan Elevated Railroad Company in this city, and afterward for three years as chief engineer of the Union Pacific Railroad in Wyoming, Idaho, and Montana.

TAKING A PHOTOGRAPH BY THE MAGNESIUM LIGHT.

Taking portraits at night by the electric light is now a matter of every day occurrence, and has many advantages, but as an experiment it is too expensive for the amateur photographer to undertake.

Our engraving illustrates a novel and easy method of photographing by the aid of the magnesium light. If a magnesium ribbon of a certain length be used, the ash will sometimes drop and suddenly extinguish the light.

This difficulty may be overcome by the use of magnesium powder mixed with fine sand. Upon a metal or wooden rod six or eight feet long is clamped an alcohol soldering lamp capable of giving a large horizontal flame, and above it a funnel of tin or brass with a short mouth about three-quarters of an inch in diameter. The lamp should be quite close to the funnel; the rod may be secured at the bottom to any suitable base of wood or metal, and may rest upon a table instead of the floor. A pan or dish set upon the base will catch any falling particles.

The proper focus may be obtained by focusing upon the flame of a candle placed where the person is to sit. The shadows are softened by reflecting the light with a white muslin screen secured to a frame which may be tilted at any angle, as shown. No cap is used on the lens.

One thimbleful of magnesium powder is mixed with two of fine sand, with a spoon or piece of wood upon a white sheet of paper.

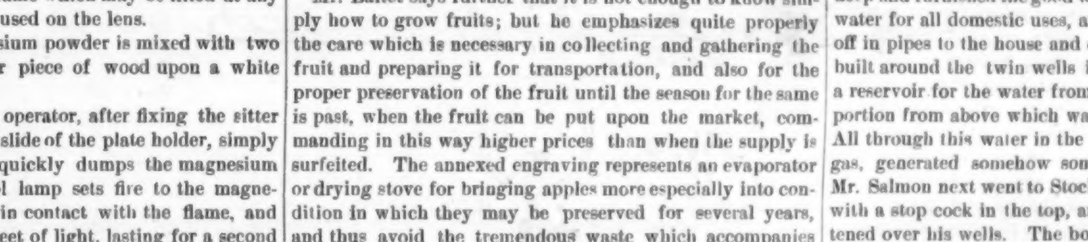
To make the exposure the operator, after fixing the sitter in position and drawing the slide of the plate holder, simply steps up to the funnel and quickly dumps the magnesium mixture into it. The alcohol lamp sets fire to the magnesium *as it, in falling*, comes in contact with the flame, and a long, *brilliant*, dazzling sheet of light, lasting for a second or two, is the result. Such a brief exposure is generally sufficient. The duration of the flame can be regulated by the addition or subtraction of the magnesium or sand.

Should a picture be over exposed, the duration of exposure can be shortened by the addition of a little sand and a corresponding diminution of magnesium powder. If a larger amount of magnesium is used in proportion to the sand than that stated, the light will be more brilliant and of short duration. By varying the proportions of the two, it is possible to produce a flame of light from six to seven feet in length.

The large area of the light tends to diffuse the same, softens the shadows, and gives to the picture a brilliant effect.

By varying the position of the light, very artistic effects of light and shade may be produced. The sitter should be placed so as to look away from the point where the light is to appear, in order that the dazzling effect of its intense glow may be avoided. Once the proper proportion of magnesium powder has been ascertained, several exposures may be made one after the other, with the certainty of obtaining good pictures each time.

As an experiment nothing can be more attractive and entertaining than taking a photograph at night.

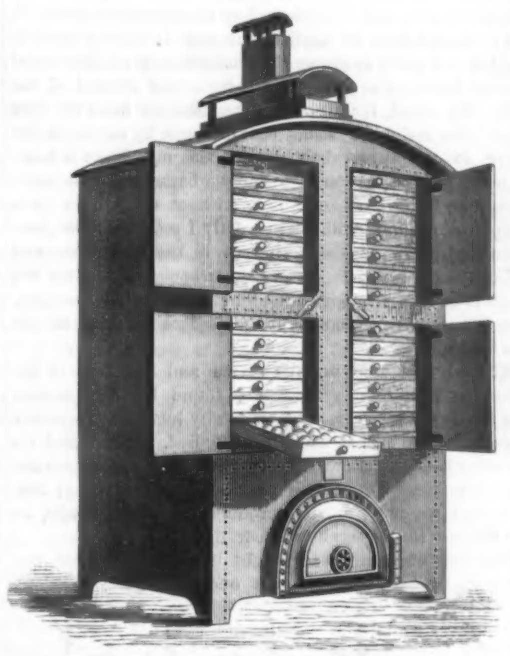


PHOTOGRAPHING BY THE MAGNESIUM LIGHT.

METALLIC paper is a recent French invention, and chromolithographs are rendered transparent by a coating and backed with tinfoil. The effect is said to be very striking, and the applications are very numerous.

APPARATUS FOR DRYING FRUIT.

Mr. Baltet, of Paris, has recently published a very interesting work upon the "Cultivation of fruit for market and family use," and it contains so many good hints and such instructive drawings that we have taken the liberty of reproducing one of his illustrations, showing a very simple but highly practicable apparatus for drying apples and kindred fruit. The work treats principally of matter relating to propagation of fruit yielding trees and plants, and gives useful hints as to proper culture of trees from a commercial point of view.



APPLE DRYING APPARATUS.

Mr. Baltet says further that it is not enough to know simply how to grow fruits; but he emphasizes quite properly the care which is necessary in collecting and gathering the fruit and preparing it for transportation, and also for the proper preservation of the fruit until the season for the same is past, when the fruit can be put upon the market, commanding in this way higher prices than when the supply is surfeited. The annexed engraving represents an evaporator or drying stove for bringing apples more especially into condition in which they may be preserved for several years, and thus avoid the tremendous waste which accompanies every season that we have of especial abundance. Nearly every fruit farm in France possesses apparatus more or less similar to one shown in the engraving.

It is believed that a bushel of fresh fruit will yield about six pounds of the dried fruit. The construction of the drier may be seen at a glance, and consists simply of a closed chamber provided internally with tiers of drawers, and with a stove located at the base, so that the heat as it ascends will pass over the fruit as it lies on the shelves, while a circulation of pure air is constantly kept up through the opening at the top of the chamber. We quote a few words in conclusion:

"Everywhere the culture of fruit trees is making progress, and if we cross the Atlantic we shall see it developing itself there in an extraordinary degree. The people of the United States, who devote to their orchards an area of nearly 5,000,000 acres (representing yearly 300,000,000 dollars), in 1883, at the close of so many other congresses, convened a special meeting for the discussion of the different modes of packing and transporting fruit. Let us, then, prepare ourselves for the struggle. The New World means to swamp our markets with her fruits, as she has already tried to do with her corn and meat."

A California Gas and Water Well.

Cutlar Salmon lives near French Camp, a small settlement nar far from Stockton, Cal. Others had been boring artesian wells, and he determined to try his luck. He sank a well with a seven inch tube to a depth of about 840 feet, and struck a copious stream of excellent water. Desiring to learn whether he could increase the flow by going deeper, and fearing that, should he continue the well the same size, he might injure the quality of the upper strata of water, Mr. Salmon hit on the plan of sinking a four inch tube inside the seven inch one, and then making what might be called the experimental well, four inches in diameter. This inner one he bored to a depth of 1,250 feet, and then came to water again. This lower stream came to the surface, and, indeed, rose in a tube twenty-two feet above the ground. This last water found was unfit for drinking, and but for an accidental discovery of its wonderful properties might have been considered a nuisance, as are many things the uses of which we do not know. It was found that there was a large amount of gas in this water from the lower depth. This came bubbling to the surface, making one think of a gigantic soda fountain. Some one suggested the idea of seeing if the gas would burn. A coal oil can was put over the top of the tubing, and having a few holes punched in it, an improvised gas fixture was in hand. Only a match was required to complete the preparations. The match was lighted and applied to a hole in the can, and the flame shot up three or four feet into the air, and burned steadily. The gas would burn. Mr. Salmon had fire and water coming out of the same hole in the ground.

The tube of the outer well, that which was only 840 feet deep and furnished the good water, was tapped, and sufficient water for all domestic uses, and for the stock, etc., was led off in pipes to the house and other localities. A curbing was built around the twin wells in such a way that it formed a reservoir for the water from the 1,250 foot level, and that portion from above which was not conveyed away in pipes. All through this water in the reservoir came bubbling up the gas, generated somehow somewhere down below. When Mr. Salmon next went to Stockton he had a gasometer made with a stop cock in the top, and this he took home and fastened over his wells. The bottom was beneath the surface of the water in the reservoir, and gas speedily filled the bell-shaped receiver. The next thing was to attach a gas pipe, and connect his homemade gas machine with the house. He put a pipe perforated with small holes across his large open fireplace, turned on the gas, applied a match, and the problem of cheap fuel was instantly solved. After that, gas pipe was put into the fire-box of the kitchen stove, and now the meals are prepared with the new fuel. Mr. Salmon has also used this gas for illuminating, but it does not seem to entirely fill the bill, although it is a great improvement on a tallow dip. It has been suggested that, as this gas seems to be almost pure hydrogen, it might be carbureted, and its illuminating qualities improved. But poor light or good, Mr. Salmon is certainly a lucky man, in that he gets his fuel so easily. The gas throws off a great amount of heat, and without doubt such a well would supply a large number of families with the means of warming their houses and preparing their food. Colonel Orr states that he has examined this well carefully, and thinks there is gas enough issuing from it to run a twenty horse power engine.—*San Francisco Bulletin.*

HUMAN skin and that of young rabbits have been successfully applied in small pieces to large healing surfaces in wounds. Dr. Wilson, however, in the *Medical News*, claims to have obtained very much better results from the use of the internal membrane of hen's eggs. The egg should be fresh and warm.

APPARATUS FOR ENLARGING MICROSCOPIC SLIDES.

To the Editor of the Scientific American :

In the SCIENTIFIC AMERICAN for February 16, under the title of "An Electric Microscope," I notice that the apparatus there mentioned for exhibiting magnified views of microscopic objects is spoken of as attracting no little attention. Some time since I constructed an instrument with which I have successfully accomplished the same object. In magnifying power I have equaled and even excelled the power mentioned in the article referred to above. For instance, a piece of a fly's eye less than one-sixteenth inch in diameter was exhibited in a bright and well defined picture, 10 feet in diameter. This could have been enlarged very much without impairing the distinctness of the view had space permitted. A bee sting was made to appear more than 20 feet long. The cells of wood were especially attractive, those of pine appearing from 1½ to 2½ inches in diameter. These objects, with about seventy-five more, were exhibited to my school. I have made use of both the calcium light and the electric light, but in the instrument here described sunlight was used.

Fig. 1 is a sectional view of the instrument, which, so far as I know, is different from any plan heretofore adopted. The optical parts are two reflectors, *a* and *b*, supported on two arms each, *j* and *k*, and swinging at the points, *a* and *b*, a convex lens, *c*, a concave lens, *d*, a small condenser, *e*, and the object glass, *g*. The mounted object is placed across the opening in *f*, over which an adjustable diaphragm works, not shown in the figure.

H consists of three tubes, the inner and longest one being rigidly attached to *n*, and placed at an angle to *n o o* equal to the latitude of the place. The tube or ring, *h*, to which the supports, *j*, are attached, revolves about the inner tube by means of a rack and worm screw, *m*, which is turned either by hand or clockwork. By this the reflector, *a*, is made to follow the sun. The ring, *i*, to which the supports, *k*, are attached, may also be turned around the inner tube by hand.

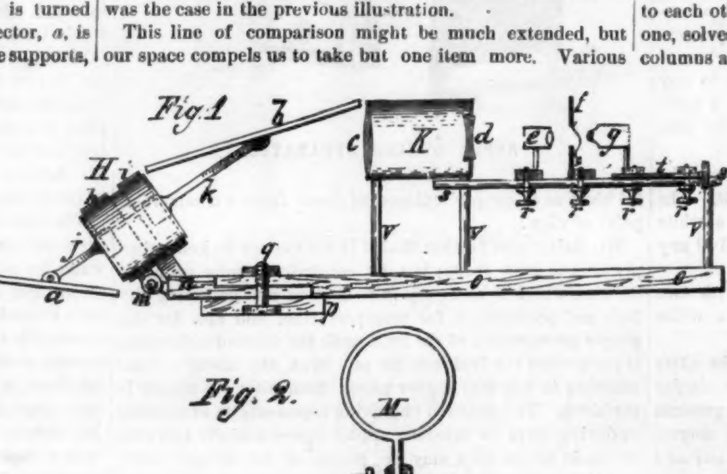
The parts, *e f g*, are supported upon and slid along two rods, *s s*, and are clamped in any position by the screws, *r r r r*; *t* is a screw for fine adjustment of *g*.

The parts, *n o o*, are of wood, 4 inches by ¾ inch, and 22 inches long. They can be turned about the joint, *g*, which is immediately below the center of the reflector, *b*. The piece, *p*, extends 2 inches beyond either side of *n o*, and is screwed fast to a window sill when in use. The three pieces, *p n o*, all turn independently.

The instrument is used as follows: Attach it by the piece, *p*, to a window on the east, south, or west side of a room where sunlight can be reached. Now turn *n* so that the line, *a b*, points toward the pole star, or approximately north and south. Then turn *o o* to point toward the place where the picture is to be shown. The ring, *i*, and reflector, *b*, are next so adjusted that the light is thrown through *c d e g*. After that the only move ment required is accomplished by the screw, *m*. Of course the reflector, *a*, must be adjusted to reflect the light through H, parallel to a line, *a b*, but this can be done once and clamped, after which no change is necessary, whatever be the position of the instrument.

Fig. 2 gives a larger view of the part, *e r*, which is almost like *g r*; *s s* are the rods on which a grooved piece, *s*, slides and is clamped by the piece, *w*, and screw, *r*. The lens, *m*, is adjusted in height by the screw, *y*, and sideways by the screw, *x*.

REYNOLD JANNEY.



APPARATUS FOR ILLUMINATING AND ENLARGING MICROSCOPIC SLIDES.

Electricity: its Relation to Vital Power.

In the SCIENTIFIC AMERICAN of March 29, we offered some suggestions on this topic in connection with the fermentation of beer; but in order to study it more carefully we must pass away from the extremely low forms of life, the bacteria, whose presence and potential activity we recog nize in the process of fermentation, and look to those of higher grade. Laboratory experiments on various animals —frogs, birds, rabbits, etc., for instance—and clinical observations on human subjects, are at our service, and in considering them it is necessary to premise that when we speak of vital force we are compelled to use the term as being the equivalent of nerve force, for we know nothing else in which to express it. For our present purpose these two may be correctly deemed identical, without discussing the minute biological points involved in such an assertion.

The question then arises: Is there a relation between electricity and nerve force? Have they anything in common? These are questions of almost infinite importance in relation to the welfare of every human being. The electrical conditions of the atmosphere are totally unstable, changing from hour to hour, and if the force which they represent is allied to our own vital force it is impossible to resist the conclusion that the bearing of these fluctuations on the health of the whole human race must be powerful for good or for evil.

It was formerly a common thing to speak of the "electric fluid." This term was used because the mysterious agent could be conducted from one place to another; it would *run* as water does in a pipe; it was produced in one place and ran along to another, following certain substances, which were called conductors. Nerve force does precisely the same thing. It originates only in the nerve cells, minute microscopic objects, which, however, are in many places grouped into such masses—called ganglia—as to be of appreciable size. These, from their color, are called the gray matter of the nervous system, while the cords which we know as nerves, running to every part, are white. These nerves are simply the conductors; they originate nothing, any more than do telegraph wires. Here is the first similarity of nerve force to electricity; it is found in the battery (the nerve cell), and is connected by the wire (the nerve).

The second item of similarity is that electricity directly applied to a nerve produces the same effect as an increase of its own force. The muscles are under the control of the will. My mind, for instance, determines to bend my fore finger; the brain cell sends the message by means of the nerve to the appropriate muscle, and my finger is bent. If now, on the contrary, I apply a battery to that same nerve, the finger is at once bent, without my will, or even in opposition to my will. Apparently I send the *same force* from the battery that the brain sent in the other case, and as I can easily make the battery the stronger of the two, the finger is bent even though I determine that it shall not stir. This is one strong proof of the absolute identity of the two forces.

Still again, in studying the action and functions of the sympathetic nerve or system, it is found beyond question that the direct application of electricity increases the power of action of the part to which it is applied. It is found, on the other hand, by clinical observations, that whatever tends to exalt the nerve force does precisely the same thing; that is, nerve force and electricity produce the same results, as was the case in the previous illustration.

This line of comparison might be much extended, but our space compels us to take but one item more. Various types of fishes possess electrical power, and are in each case provided with special organs for its production. The best and longest known of these electrical fishes is the torpedo, of which we have one species here on our Atlantic coast and another on the California side. The "battery," by means of which they are able to give really powerful shocks, is quite similar in structure in all the species; it is situated well forward on each side. But the only point which interests us at present is that which gives it its special and wonderful power. It is provided with an exceedingly rich distribution of branches from the trigeminal nerve and the pneumogastric. These are ramified upon each cell of the battery, and they alone give it its energy. The nature of this power has been often tested, and it has been found capable of doing whatever the electricity produced in our laboratories, from our ordinary batteries, can do. There are no means of distinguishing the one from the other, they are apparently identical, and yet we know that the power shown by the torpedo is vital; it is simply nerve power.

Why this function should pertain to those two nerves alone is not apparent; inother fishes there is no such. And in other electrical fishes those nerves are not the agents. In the electrical eel of Surinam the battery is quite similar in its structure to that of the torpedo, though differently situated; but the nerve supply comes from multitudes of branches of the spinal nerves, while the trigeminal and pneumogastric are not involved at all, but the electrical power appears to be entirely the same.

It would seem, therefore, that electrical force and nerve force must be identical; but there are, on the other hand, points of discrepancy which must not be neglected. The mode of distribution is widely different. It is a matter of great difficulty to retain electricity after we have produced it. It escapes with exceeding ease, and the most careful insulation will hold it but imperfectly, especially where moisture can reach it. Nerve force, on the contrary, originates among the moist tissues, and passes everywhere freely among them without any tendency to escape from the line of its own moist conductors—the nerves. It is true that this does not disprove identity, for it may be only one feature, as yet imperfectly understood, of one out of perhaps several types of electrical energy; and the same remark may apply to the fact that different nerves, which so far as we know are identical in structure, convey nerve force to totally different types. We have nerves of sensation, of motion, of sight, of hearing—of all the special senses. Are these all only distinct forms of electrical action?

It seems probable that from all these sources of inquiry we may draw the inference that even if electricity is not identical with our nerve force, it is at all events so closely allied with it that electrical changes must surely influence human vitality, either for good or for evil. A.

Grecian Stone Cutting.

A rather interesting observation has recently been made upon the methods of stone cutting employed by the ancient Greeks. Every one knows that the marble blocks of which the Grecian masonry was composed are put together without mortar, and so nicely fitted that in many instances two adjacent stones have, as it were, grown together by the cohesion of their particles, brought into almost absolute contact; a fracture made by a blow upon one passing directly into the other, just as if the two formed a single block. With regard to the fitting of the drums of columns, Mr. Penrose, the most scientific and practical of all investigators of Greek architecture, believes that the desired effect of close fitting was obtained by inserting a wooden pin as a pivot in the drill holes which are always found in the centers of the drums, and revolving each drum upon the one below it, first placing sand between the stones, until a perfect joint was obtained, in the same manner that glass stoppers are ground into bottles, and pieces of metal work of certain kinds fitted to each other. This explanation, which is probably the true one, solves the problem completely so far as the drums of columns are concerned, but throws no light upon the fitting of the other stones of the Grecian buildings, such as the blocks of the entablature, which are found to have joints as close as those of the columns, the edges of each block, for a certain distance back from the face, being polished, while the rest of the joint is slightly sunk, in order to allow the polished portions to be brought into perfect contact. As no sign of a pivot can be discovered on the stones, even if it were possible to revolve them in contact with each other, it is plain that a different process must have been used for fitting them, and an inscription discovered a few years ago gives us some idea of what the process may have been.

This inscription, which seems to have been a sort of official document, answering the purpose which would now be fulfilled by a printed specification, describes the construction of a temple, and stipulates particularly that the joints of every block of marble must be polished with a mixture of oil and vermilion. As vermilion, if the word so translated really refers to the pigment now known under that name, has no polishing quality, it has been suggested that the color was used simply to spread over the joints before trying the stones together. If any inequality existed in the surface of either stone, it would be immediately shown, on separating the stones after a momentary contact, by the transfer of color from one to the other; and the protuberant portion, thus detected, could then be rubbed down by hand to a uniform plane with the rest of the surface. A powder of red chalk is often used by marble cutters for a similar purpose, and it is quite possible that this may have been the only use of the vermilion paint; but there is some difficulty in accounting on this theory for the mixing of oil with the paint, which, if used dry, would be quite as useful for its supposed purpose, and would be much more easily cleaned off the stone. There is no serious improbability in the supposition that the authors of the inscription may have confounded the true vermilion with the red oxide of iron, or crocus, which is a very efficient polishing agent, and if mixed with oil, and applied to the surface of a piece of marble, would serve admirably, both to show where that surface had been brought to coincide with a test plane, and to reduce the inequalities which might on trial be found to exist.—*American Architect.*

The Mullein Plant.

A good deal has been written lately about the mullein plant and its efficiency as a cure for consumption. Extracts and decoctions of this plant (*Verbascum thapsus*) were recently exhibited at the Cork Exhibition, but the judges would not pass any verdict, as the chemical and physiological properties have not yet been investigated. It is, under the synonym of cow's lungwort, popularly looked upon as of value in diseases of the respiratory organs.

In reference to the use of the above, Dr. Quinlan, of Dublin, writes to the *British Medical Journal* that three ounces of the green leaves should be boiled for ten minutes in a pint of new milk. The liquid is then strained, sweetened to taste, and drunk while warm. This dose can be repeated twice or three times a day. This high authority has no doubt of its efficacy as a curative in the earlier, and a palliative in the later stages of pulmonary consumption. Care should be taken to use the leaves of the great mullein, known by its thick, mucilaginous, and wooly leaves.

PLAN TO INCREASE THE WATER SUPPLY OF NEW YORK.

(*Continued from first page.*)

The aqueduct from Croton dam is of masonry lined with brick, and has a sectional area of 53·34 square feet. The Harlem River is crossed by the famous High Bridge, built of granite masonry, and having 8 spans of 80 feet and 7 spans of 50 feet, its length being 1,393 feet between the gate houses. The height is 100 feet in the clear above tide water. The water was first carried across in two 36-inch pipes, but in 1860 the capacity was enlarged by the addition of a wrought iron pipe 7 feet 6½ inches in diameter. This makes the pipes equal in capacity to the aqueduct.

Before 1840 a rectangular reservoir 836 feet wide, 1,826 feet long, and 20 feet deep, holding 150,000,000 gallons, was built about six miles from the Battery. Twenty years later a receiving reservoir having a capacity of 1,200,000,000 gallons was built next to this one. The distributing reservoir at Forty-second Street is 400 feet square, and holds 24,000,000 gallons. A high service reservoir holding 10,800,000 gallons was built in 1866 at the west end of High Bridge. Engines supply an iron stand pipe and tank, the flow line from which is 324 feet above tide level.

Elevations greater than this aqueduct are supplied by the two steam engines at High Bridge, which have a combined daily capacity of 10,000,000 gallons. In 1879-80 another high service supply was obtained from two engines pumping into a stand pipe 170 feet high located at Ninety-eighth Street. All of the water mains are of cast iron.

For several years the supply furnished by the present works has been insufficient; the population and manufacturing interests have grown more rapidly than was dreamed of, and, judging by the past, will continue to increase in a yearly greater proportion. That the case is urgent and demands quick and effective measures is not disputed. Two plans present themselves: one is to build so as to meet immediate wants, the other is to build to meet future wants—in other words, to build for ourselves only, or to build for our children's children. Nothing can show the fallacy of the first method better than the brief sketch above given of New York's water system, which has been only a succession of patches added every few years, each addition being probably made in the vain hope that the city would stop outgrowing its water supply. The alternative is to so build that we shall be prepared to supply an ample quantity of water for all the wants of all the people of New York city for all time.

Purity of the source of supply is the first and most important consideration. It would be hazardous to utilize a watershed which would require a system of drainage to remove material that might contaminate the water. It would be extremely foolish to take a water supply from a built upon section of country, every foot of which would have to be rigidly, carefully, and constantly guarded to keep away impurities. In deciding upon a plan to provide water for a city of the size and importance of New York, it is false economy to let the question of cost prevent the adoption of that scheme which will best meet all the requirements.

Several plans are now being considered by a commission appointed about a year ago to select a plan for obtaining an adequate supply. One of these is shown in our frontispiece. It contemplates damming the Croton River at Quaker Bridge, a point about four and one-half miles below the present Croton dam. This would catch all the water from the small tributaries of the Croton, the total watershed of which amounts to 362 square miles. The dam will measure about 192·5 feet from the top to the top of the foundation; and in the deepest part the foundation will be 69 feet high. The width at the base will be about 200 feet, and at the top 22 feet, on which will be a roadway. The length at coping will be 1,350 feet; length at datum level will be 510 feet; width at that level, 172 feet. Along the top of the face of the dam will be a line of arches forming a cornice. The outline drawings show a cross section and plan. The foundation will be concrete, and the main dam rubble masonry faced with stone work. The estimated cost of the dam is $5,000,000.

At the north end of the dam will be two spillways, formed between two knolls placed in a line, making an angle (down stream) with the dam. The waste water will run down a ravine, entering Croton River some distance below.

At a distance of six miles above Croton dam will be placed Muscoot dam, a subsidiary one designed purely for sanitary purposes; it will be the same height as the spillways of Quaker dam. The duty of this dam will be to keep the country constantly flooded, even if the water should be drawn off from both the Croton and Quaker ponds. The Quaker dam would raise the water level 34 feet above the top of the present Croton dam.

The present aqueduct will be connected with Quaker Pond at three levels, thereby permitting the selection of the purest water in the pond to be sent to the city. The old gate house at Croton dam will be enlarged and connected with both the Croton and Quaker ponds at different levels, to allow the drawing of water from either source. A new aqueduct will lead from here to the city. An aqueduct will connect Muscoot with Quaker Pond, in order to allow Croton Pond to be emptied without interfering with the supply. Openings will be made through Quaker dam, in order that the water may be drawn off if necessary.

It is calculated that Quaker dam will impound thirty-two billions of gallons of water, which would be sufficient for a 160 days' supply of 200,000,000 gallons each.

If carried out, this scheme, only the main points of which we have mentioned, would furnish a storage reservoir of ample size, and in a good locality if at any future time it became necessary to take water from a source further north. This idea is by no means a visionary one when we remember how our small streams are drying up.

Correspondence.

A Good Suggestion.

To the Editor of the Scientific American:

I have followed the advice of the SCIENTIFIC AMERICAN, and done what I could to defeat the proposed patent laws in Congress. In addition I have asked our Senator to amend section 4,900 of Revised Statutes so as to *require* manufacturers, when practicable, to affix to their patented goods the numbers and dates of their patents, and secondly, in all cases to furnish the numbers, dates, and title or subject of patents involved.

My reason for so doing is this: I have found in some makers of machinery, claimed by them to be patented, a disposition to make a secret of such numbers and dates. In some cases have been met by an impudent inquiry as to my motives in making such a request. Now, if I understand the spirit of the patent law, it is the right of every one to inquire fully into any patent he sees fit, and makers of patented goods should be compelled to give any inquirer the numbers, dates, and titles of their patents, if they offer goods, claimed to be patented, for sale.

I add the word title, because some machines have so many patents that it would be a great hardship to compel a person to buy copies of the whole lot in order to investigate one particular point.

W. S. PROSSER.

Anbury, Cal., April, 1884.

[The suggestions of our correspondent are good, and doubtless the public convenience would be promoted if patentees were required to stamp their goods as above indicated.—EDS.]

A Trip on a Fast Locomotive.

To the Editor of the Scientific American:

Having occasion lately to pass over some branches of the Pennsylvania and Reading Railroad, a permit to ride upon the locomotives gave me opportunity to observe some striking points as to their work and wear.

At Bound Brook the Pennsylvania and Reading Railroad joins the Central of New Jersey, forming the Bound Brook line between Philadelphia and New York. South of that point Wootten locomotives are used on fast trains. North of it, standard Baldwins. The train leaving Philadelphia at 7:30 A.M., engine 364, makes the run to Jersey City in one hour and fifty minutes, schedule time, including some eight or ten stops and "slow ups." A stretch of seventeen miles between Princeton Junction and Bound Brook, including two slow ups and one stop, was run in exactly seventeen minutes. Of these seventeen miles, eleven in succession were run in nine minutes and ten seconds, being a rate of seventy-two miles per hour. And of these eleven, two successive miles were run in forty-seven seconds each, being a rate of 76·6 miles per hour. This was the regular daily run; we were not behind nor making up time.

Even at these high speeds the engine ran about as smoothly as a first class car. I have many times experienced severer vertical and lateral oscillations in such a car on reputable roads at forty-five miles per hour. So smooth, indeed, was the run that instead of any nervousness as to the safety of such speeds, the query constantly suggested was: Why may not a higher speed be obtained with entire safety? Or is there anything to prevent it but the problem of making the requisite steam?

In fact, safety at high speeds is aimed at in these engines, oddly enough, by placing the center of gravity very high—perilously high it at first appears; but when it is considered that the higher the inclination of the lines from the center to the rails, within the limit of safety from capsizing, the more lateral shocks will be eased by the springs, then it ceases to be a wonder that lateral oscillations are so little felt, for the reason that as *sudden* shocks they cease to exist. And take away the *sudden* heavy impact of the flange of the wheel laterally against the rail, and the danger of the wheel climbing the rail is taken away.

The firing and steaming of these engines is to be noted also, as they are the prime condition of the high speeds. The fire box is placed above the level of the top of the drivers, and extending out the full width of the engine overhangs them. An immense grate surface is thus obtained. Water tubes traverse the mass of fuel fore and aft, promoting circulation. The crown sheet is separated from the fire box by a wall of firebrick rising above the level of the fuel, and by a hot air or flame chamber between it and the fire brick. The crown sheets hold the largest number of the smallest brass tubes I ever saw in a locomotive boiler.

The force of the blast being expended through so broad an area of fuel the velocity of the air current through it is reduced, and as a result but very little cinder, and that the very finest, is ever drawn through the tubes. True, a spark arrester is placed in the smoke box—to comply with the law—but it arrests nothing, for nothing coarse enough to be arrested by it passes through the tubes, in other words, the stuff is all burned up in the fire box. The fact that these boilers are able to utilize what is known as "buckwheat" size coal, making steam very freely with it, is a strong point in their favor.

Notwithstanding the rapid evaporation effected—as high as forty-seven gallons per minute—they are not flighty. In the entire run above referred to the gauge did not vary three pounds from 135, due in part, perhaps, to an occasional blow-off, while slowing into the water tank.

Let any one who is in love with a swift, easy motion, like being borne through the sunlight on the thigh of a big angel, get a ride on one of these machines.

On the return from New York, I rode to Bound Brook on a Baldwin engine, No. 165, having a remarkable record, viz., that of having run 119,360 miles consecutively, without any general repairs, her weight having not once been lifted from her drivers in that period.

On the following day a run up the valley of the Schuylkill to Pottsville and back, gliding along fair interval lands, sweeping around bold mountain bases, rushing through those roaring hives of iron industry, and even making the descent, 1,300 feet, of Pleasanton's coal shaft, all could not divert attention from the fact that a small angel may make a very swift flight, the little Ariel, the manager's private engine, elegantly fitted to carry six persons, at our service, with little cylinders of ten inch stroke and drivers of three and a half feet, making a speed often of forty-five miles per hour.

The present advanced condition of railway service, however, has vastly more in it suggestive of advancement yet to be made than of perfection reached; and he is a bold prophet who undertakes to tell what the railway of the future shall *not* be.

B. W. P.

An Illinois Inventor to Illinois Senators.

Mr. Eric U. Norberg, of Toulon, Ill., has written to the Senators from Illinois, concerning the hostile patent bills, as follows:

"If such stupid and unjust bills should become law, it would not only be a gross violation of the rights already granted to inventors, but would also have a tendency to stop at once all inventions hereafter. It would be a legislation in support of the bad principles advocated by the socialists and communists, denying individual or separate rights in property; and if, in the start, one class of property is by law declared to be common property, owned by no one particularly, how long would it take till such a fanatical and wild doctrine would include all other property?

"There is already considerable excitement over these hostile patent bills, and many are more or less uneasy for fear they may become law, and this excitement may lead to a political organization for the protection of this interest.

"The superior wisdom of the Senate cannot overlook the fact that a large part of the productive industry of the country is the direct result of useful inventions, and that the successful development of our vast resources, our future prosperity and progress, if not civilization itself, depends to a great extent not only on inventions already made, but also on such that skill and ingenuity may hereafter bring forth.

"For these reasons herein set forth, I respectfully ask that you will use all your influence to prevent the concurrence by the Senate in, or passing, any of the bills referred to above."

The Milling World Says:

"The patent bills offer a fruitful field of discussion to all trade journals at the present time. If public opinion has anything to do with the formulation of laws, surely the advocates of the pending new patent regulations must have found out by this time that the large majority is against them, for all journals are most unanimous in condemning the bills as well as their advocates. A correspondent of the SCIENTIFIC AMERICAN touches a key note by the proposal that all inventors, and those interested in the progress of the country, should obtain as many signatures as possible to a pledge, that no advocate of any of the present new bills shall ever receive their vote at any election. Such pledges pouring in on these wise law makers from all parts of the country would beyond doubt have the desired effect upon the legislators, and demonstrate to them in what direction they must look for political support. The *Milling World* cordially indorses such a proposition, with the firm conviction that our existing patent laws, because far from perfect, should be made more efficient for the protection of the interests of both inventor and public, but not changed in any other manner. If we cannot improve them for the benefit of everybody, do not let us try to alter them to the detriment of many and to the advantage of a few mercenary individuals, but rather let 'well alone' and leave them in the present form."

Training Dogs to Patrol Mines.

A Zanesville, O., correspondent writes us that dogs may not only be made profitable workers in mines, by being taught to draw small coal cars, but it is entirely feasible to teach them to patrol mines, as detecters of the presence of fire damp or natural gas. A dog of 16 or 20 inches high is recommended as likely to be most serviceable in the work, but he should be so trained by the watchman as to be always ready to rapidly make the rounds of the mine before the latter starts. The plan is to send the dog through the mine. If he returns, it will be known that the mine is safe. Failure of doggy to come back indicates danger from gas.

Manganese: its Ores and their Uses.

BY PROF. E. J. HALLOCK.

In commerce and the arts the term "manganese" is applied to an ore, the technical name of which is *pyrolusite*. The term "brown stone" is likewise a misnomer, since this ore is not brown, but black, intensely black, as those who handle it well know, for it blackens the hands like coal.

In its scientific meaning the word "manganese" is applied to a metal that occurs in a number of other ores as well as in pyrolusite, and somewhat resembles iron both in its pure state and in its compounds.

Pyrolusite is a binoxide of the metal manganese, and in early times was mistaken for an ore of iron. From its resemblance to loadstone it was called *magnesia nigra*. The earliest mention of it, according to Bolton's *Index to the Literature of Manganese*, may be found in Cæsalpin's *De Metallicis*, published in 1596. Although known so long, and quite extensively employed by glass makers, it was not until 1740 that Pott found that the metallic element which it contained was not iron. (*Miscel. Berolinensia*, vi., 40.)

As already mentioned the first use that manganese compounds found was in glass making, to destroy the greenish tinge caused by iron; following this came the discovery of "chameleon mineral" by De Morveau in 1780–90 (*Jour. de Physic*). In recent times, however, it has found a use in metallurgy, which has greatly increased the demand for its ores.

The principal ores and minerals containing manganese are the following:

Pyrolusite, or black oxide of manganese, containing 63 per cent of metal, when pure. It occurs either crystalline or massive. The former forms long columns, which are often divergent, forming rays, either iron black or steel gray in color, and having a metallic luster. When massive, it looks granular and opaque. Its hardness varies, while its specific gravity is 4·82. It occurs abundantly in different parts of this country from Vermont to Georgia and California. It is easily recognized by the copious evolution of chlorine gas when heated with hydrochloric acid, and of oxygen when heated with strong sulphuric acid, in connection with the usual manganese reactions, viz., an amethystine bead with borax, a green one with soda.

Manganite, a hydrated oxide of manganese, with 62½ per cent of the metal. Its appearance and characteristics resemble those of the former ore.

Psilomelan is also a hydrate, and like pyrolusite dissolves in hydrochloric acid with the evolution of chlorine. It is found massive, stalactitic, or in rounded masses, but never crystalline. It is found at Chittenden, Irasburg, and Brandon, in Vermont.

Wad is a loosely aggregated hydrate of bluish or brownish black color. It seems to have resulted from the decomposition of other manganese ores. It often contains iron, cobalt, barium, and copper. It occurs abundantly in this State and elsewhere.

Rhodochrosite, or carbonate of manganese, is the most beautiful mineral of this class, and finds use as ornament rather than ore. In color it varies from pink to rose red and brown, being mottled or shaded with various tints. Its luster, when polished, gives it the appearance of a beautiful marble. It has been found in New Jersey and Nevada, but is not abundant.

Franklinite deserves mention here, as it contains 12 to 16 per cent of the oxide of manganese, and is very abundant in New Jersey.

Manganese occurs in many other minerals, and even in the ashes of plants, especially those of birch leaves.

The ores of manganese are much more difficult to reduce than those of iron, which they otherwise resemble, hence metallic manganese is rarely prepared in a free state, but is well known in its alloys with iron known as ferromanganese and spiegeleisen.

Metallic manganese can be prepared from the oxide by reduction with carbon at a very high temperature. Also by the action of sodium upon the fluoride. It looks like cast iron, but with a tinge of red and is hard enough to scratch glass and steel. It melts at a white heat, but is permanent in the air. Unlike iron, it possesses no magnetic properties, and when alloyed with iron to the extent of 22 per cent the latter ceases to exhibit magnetic properties.

Spiegeleisen is a name applied to cast iron containing from 10 to 20 per cent of manganese and about 5 per cent of carbon. As its name indicates, it came originally from Germany, having been at first an accidental product resulting from the working of iron ores that contained manganese. It first began to attract attention about ten years ago.

As long as spiegel was used for making iron in the old way it was of very little value, for, although it produced a superior quality of wrought iron, the expense of puddling was very great. Upon the introduction of the Bessemer process it assumed an importance previously undreamed of, being found to be an indispensable adjunct to that process. It is obtained by the reduction, in a blast furnace, of iron ores containing manganese, if such are to be had, or by mixing a suitable quantity of manganese ore with the iron ore. A high temperature and hot blast is also necessary. If either of the ores contain phosphorus, or if there is any in the fuel or flux, it all passes into the alloy, hence the necessity of a very careful estimation of the phosphorus in the materials employed.

One characteristic of spiegeleisen, to which it owes its name, is its crystalline structure, with large, smooth cleavage planes, that have a tendency to iridescent tarnish.

In making steel by the Bessemer process (that of forcing air through the melted iron), when all the carbon is burned out the metal is found to be quite rotten at a red heat, or "red short." This shortness is removed by the addition of about 8 per cent of spiegeleisen.

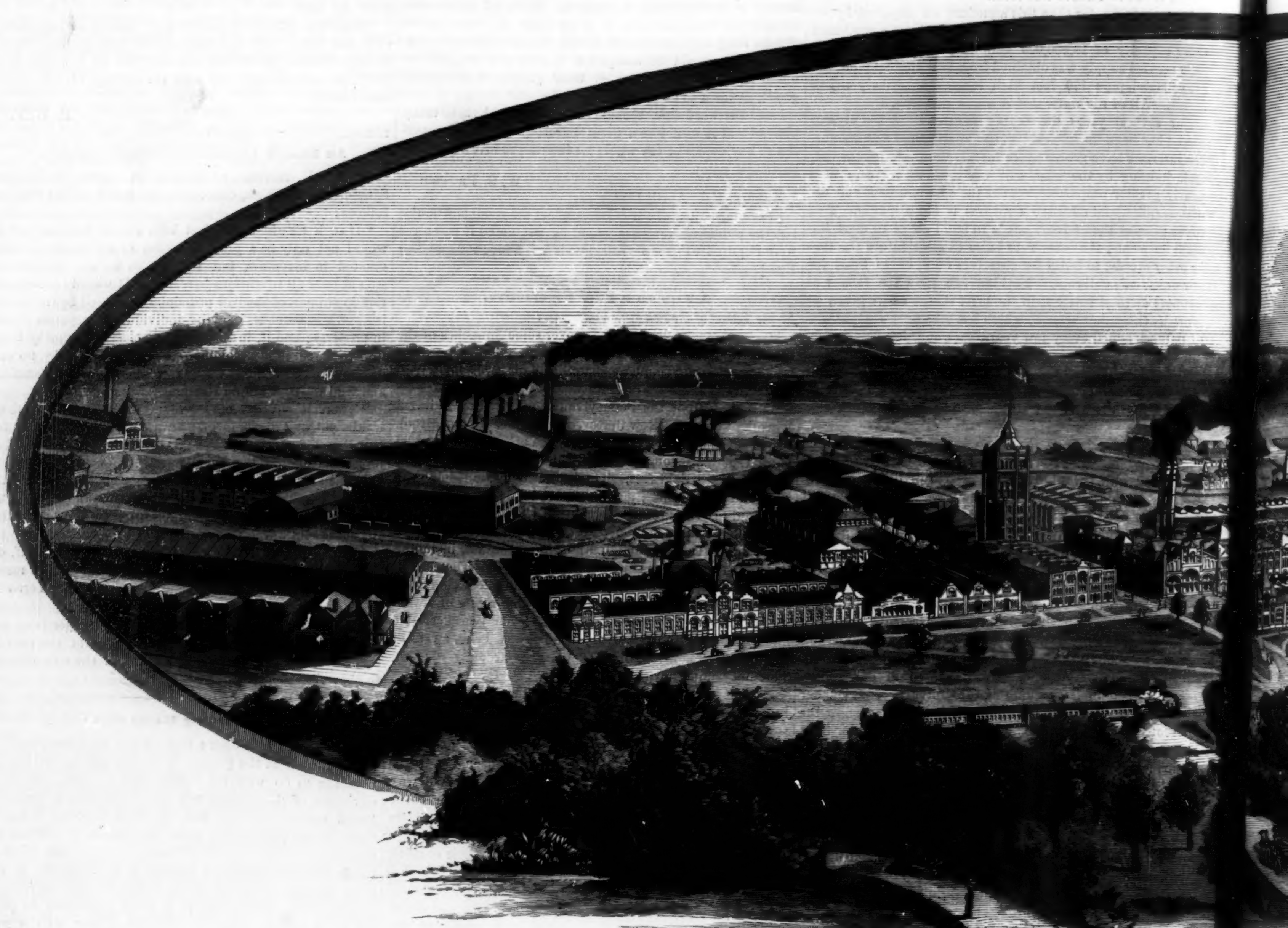
Ferromanganese is an alloy of 30 to 80 per cent of manganese with iron and only half a per cent of carbon. In Oberhausen the monthly production of 60 per cent ferromanganese is 700 tons

Manganese bronze.—In 1876 P. M. Parsons introduced an alloy which he called manganese bronze. Tests made with this metal at the Woolwich Arsenal showed that it possessed remarkable tensile strength, but it seems already to have passed into oblivion.

German silver has also been made with manganese in the following proportions: copper 80 per cent, manganese 15 per cent, zinc 5 per cent. This alloy is white, works easily, and takes a fine polish.

Rousse recommended (in *Comptes Rendus*, xciii., 546) the use of an 85 per cent ferromanganese in place of zinc in the Bunsen battery. A solution of the permanganate of potassium is employed for depolarization, but the manganese salts are easily regenerated and recovered.

The black oxide, or pyrolusite, is used not only for making the above described alloys and in glass making (as a soap), but even more extensively for making chlorine gas. It is mixed with chlorates for making oxygen, or more rarely used alone. Tessie du Motay's oxygen process, in which steam was passed over the oxides of manganese and strong alkali, has not found much practical application. Black oxide of manganese is used in the Leclanche battery, and the consumption is not inconsiderable for this purpose.



MANUFACTURING CITY OF PULLMAN AND CAR ... B

By fusion with alkalies, manganates and permanganates are formed that find considerable use in the arts, both in dyeing, as a disinfectant, or for other purposes.

The salts of manganese are distinguished for their beautiful colors, usually some shade of pink. Manganates, however, are green, permanganates deep purple, but change easily.

AN INDUSTRIAL CITY.—PULLMAN, ILL.

It is not quite four years since that, on the 25th of May, 1880, ground was first broken for the building of the Pullman Palace Car Works and the city of Pullman, Ill. At that time the land was an open and not very promising prairie; the appearance it presents to-day will be, perhaps, better appreciated from a glance at the accompanying illustration than from any description we can give. Yet the building of the city of Pullman, and the success which has marked the scope of the enterprise, represents much more than the making of a great industrial city in a wilderness in a short period of time. It was, pre-eminently, the design of its founder to build a city in which, as far as possible, all that would promote the health, comfort, and convenience of a large working population would be conserved, and many of the evils to which they are ordinarily exposed made impossible, while at the same time conducting the enterprise on thoroughly sound business principles, looking for a moderate and sure return on the capital invested. And it is not yet too early to say that the execution of this comprehensive plan has been attended with a success as great as it has been well deserved.

This young city, which has now almost reached its fourth birthday with a population of over 7,500, is situated on the west shore of Lake Calumet, five or six miles west of Lake Michigan and fourteen miles south of Chicago, on the line of the Illinois Central Railroad. The ground is almost a dead level, as it is, in fact, through most of the State of Illinois, the lake being of a soft bottom ranging from 1 to 8 feet in depth, while it is only 1½ miles wide by 3 miles long. It drains a small area, not much of the land in Pullman being more than 7 or 8 feet above its surface, and it is connected with Lake Michigan by the Calumet River. The latter, however, does not run through the lake, but is connected therewith by a small channel, through which the water flows from the lake to the river, or from the river to the lake, according to the conditions of winds and floods.

In the selection of a site the first great object was to obtain the ownership of a sufficiently large body of land, that the builders of the new city might have room enough in which to develop their plans and protect themselves from objectionable surroundings, while still being in the vicinity of a leading city, and a location thus near the great railway center of the continent presented obvious advantages. The situation is near enough to Chicago to be easily reached in even less time than it takes to travel to any of New York's suburbs from the business portion of the city; but here, with every facility which capital can control of prosecuting their great industrial enterprise, the Pullman Company have the added advantage of a permanent population of skilled labor, bound to the interests of the company by the knowledge that the latter has, with great wisdom and foresight, to leave out the idea of beneficence, shown a practical consideration for their comfort and happiness, of which there is not another similar example in the world to-day.

The industries carried on here, and for which the city has been built, include the Pullman palace car and freight car shops, the Allen paper car wheel works, the Union foundry and Pullman car wheel works, the Dunning steel horseshoe works, the Spanish-American curled hair factory, and other minor manufactures collateral to the principal business and incident to the maintenance of such a large and rapidly growing population. Not the least among the latter should be mentioned the large brick yards of the Pullman Company, as there have been used, besides 25,000 cords of rubble stone, 45,000,000 of brick in the building of the city.

One of the last completed of the large factories is the freight car manufactory, which has an area of 800 feet in length by an average of 200 feet in width, and has a capacity for manufacturing forty freight cars per day, or one for every fifteen minutes in working hours. The total number of workmen employed is about 4,000 in all the departments, the car shops alone keeping 2,500 busy. The power for driving the machinery for the principal shops, as well as the freight car shops, is furnished by the great Centennial Corliss engine, being conveyed to the freight car shops by underground shafting.

The length of the city from the north to the south end is about two miles, while the width from Calumet Lake back is about one mile, of which the dwellings at present cover over 150 acres, the city having 1,400 brick tenements, houses, and flats. The frontage of buildings extends along five miles of well paved streets, and there are fourteen miles of railroad track laid for the use of the city and shops. The buildings are all of brick or stone, and built in the most substantial manner. The homes of the workmen are upon wide, well paved, and shaded streets, and have all the conveniences of the best modern city houses.

Every house has gas and water, while the larger houses are heated by steam, have hot and cold water, and bath rooms, and the drainage and sewerage is perhaps the most perfect of that of any city similarly located in the world. The æsthetics of architecture and landscaping are also made prominent features, and the grouping of buildings and trees, to produce a pleasing effect, has been studied as diligently as the arrangement of machines in the shops.

At the left in our illustration, and at the north end of the city, are the new freight shops before referred to, and in their immediate vicinity are shown the residences prepared for the workmen in these shops, while a little further in the background may be seen the shops of the Chicago Steel Works, now in full operation. At the extreme left is shown a small portion of the south end of the shops of the Union Foundry and Pullman Car Wheel Works, an immense establishment, covering several acres of ground, and still north of which are the brick dwellings of the employes of the works, very much in the style of the residence portion of Pullman itself. The works employ 1,000 hands, and have a capacity for melting 200 tons of iron per day, with facilities for turning out castings 50,000 pounds in weight. In addition to car wheels, the great specialty of these works is architectural castings, of which they make large quantities.

In extending the view to the north, it has been necessary to omit some important structures of the residence portion, at the south end of the city. Notable among these is the elegant and commodious school building, which has been erected at a cost of $60,000, and is one of the best in the State. It has fourteen commodious school rooms for the various grades, and will seat 850 pupils. Another large building in that vicinity is called the Casino, the first floor of which is devoted to stores, while the second floor contains the rooms of the Episcopal Church, and a large photograph gallery. The other buildings left out are dwellings.

In the center foreground are the principal erecting shops of the Pullman Palace Car Company, the water tower, and the building adjacent containing the great Corliss engine,

R W[illegible]S BELONGING TO PULLMAN'S PALACE CAR COMPANY.

which furnishes the motive power for driving the multitudinous machinery of this busy manufacturing city. One of the most attractive views of the city is the Boulevard, looking east from the Illinois Central depot to Calumet Lake, about one mile in length and 100 feet wide, finely paved, and lined on either side by 200 elm trees. In the foreground, and to the right of the Boulevard, is the Hotel Florence, a beautifully situated and well appointed structure, with accommodations for 100 guests, and a dining room capable of seating 125 persons. A prominent structure in the same vicinity is the Arcade, a building of fine architectural design, 250 feet long by 164 feet in widt and 90 feet high. On the first floor are 28 stores, while on the second floor is the Pullman Public Library, with 5,500 volumes, the generous gift of Geo. M. Pullman to the city. The book cases are all of cherry, of beautiful design. The library rooms, with offices, are 60 x 65 feet. On the same floor is the Arcade Theater, capable of seating an audience of 1,000 persons; also a bank, and the architect's office. The third story is devoted to lodge rooms, offices, etc.

As a beginning toward beautifying and ruralizing the city, some 30,000 trees and shrubs have been planted along the streets and in the parks. Prominent near the lake shore at the foot of the Boulevard are the Pullman Gas Works, which supply the city with light. The city has eight miles of gas mains and 250 street lamps, and 1,400 gas meters have been set. Across the Boulevard from the gas works is the Pullman depot, and east of this, between it and the lake, are the grounds for athletic sports—base ball grounds and race course, with its grand stands capable of accommodating 7,000 spectators. Finally, the Presbyterians, Methodists, Episcopalians, Baptists, Catholics, and Lutherans have flourishing societies in the city. There are no court houses, no saloons, no jails, and only one policeman. The people govern themselves, and have no Councils or Boards, with the single exception of a Board of Education.

Perhaps one of the most difficult of the problems which presented itself to the projectors of the city of Pullman was that of providing a system of perfect drainage and sewerage, and the way in which that problem was solved has proved so complete a success that it has been noted and commented on by those who have given attention to such matters throughout the world. It is but an example of following out what has long been acknowledged as the correct theory, resulting in a thorough accomplishment of the work, at what is now only a nominal cost, and which may in future be changed to an actual profit. There was no way of getting rid of the sewage by gravity, for it was as much as could be looked for that the surplus rainfall would thus be carried off on so flat a surface as that where the new city was laid out. Lake Michigan could have been reached by a pipe six or seven miles long, and by pumping the sewage could readily have been discharged therein, according to the plan recently inaugurated of disposing of the sewage in Boston. But the Pullman Land Association found a better way than that of further contaminating the waters of Lake Michigan so near Chicago and their own borders. They purchased land three miles away, and prepared a farm of sufficient size to dispose of the sewage of 10,000 persons, also erecting suitable farm buildings thereon, for a less outlay than would be incurred in laying a pipe to Lake Michigan, and this farm has since been successfully operated by the sewage from the city of Pullman. All the water from roofs and streets is carried by one system of pipes and sewers into Calumet Lake, while the sewage from houses, factories, etc., goes through a separate system of pipes to a large cistern under the water tower, whence it is constantly pumped to the farm. In all cases outside of houses, in mains, laterals, and house drains, salt glazed vitrified clay pipe is used; within the houses soil pipes are of iron, vertical ones being wrought iron, coated with coal tar varnish, put together with screw joints, the horizontal ones being of cast iron with lead joints. The sewage is conveyed to the farm by a 20 inch cast iron main, the farm end of which connects with a closed screening tank, excluding material that will not pass through a screen of a half inch mesh. From the tank the sewage passes through a pressure regulating valve, limiting the pressure on the pipes leading to the fields to about ten pounds, and the tank and valve act to regularly and evenly distribute the sewage, in the pipes provided therefor, over the farm.

The system of sewerage thus adopted has, from October, 1881, proved entirely adequate and simple in its operation, and the ratio of deaths in the city of Pullman has been less than *seven* per annum for every 1,000 people.

The Pullman Company also have for years kept up a large headquarters for their business in the city of Chicago, for which they have just erected and are now completing an imposing structure, nine stories high, on the corner of Michigan Avenue and Adams Street, of which our illustration gives two elevations. The main object of the building is to obtain permanent general offices, but it will afford much more than this, the first three floors being devoted to the uses of the Pullman Company, the next three to general business, while the three top floors will be occupied as apartments. The edifice has a frontage of 120 feet on Michigan Avenue and 171 feet on Adams Street, and is nine stories high, perfectly fireproof from cellar to garret—fireproof tile and iron beams being used throughout. The style of architecture is a modification of the Norman round arched Gothic, modernized and adapted to the peculiar purposes for which

PULLMAN & CO.'S BUILDING AND GENERAL OFFICES, MICHIGAN AVE. AND ADAMS ST., CHICAGO.

the building is intended, the main object being to give it an expression of dignified elegance in its simple massiveness. The entrance to the apartment house is on Michigan Avenue, which has been made as inviting and pleasing as possible, while the entrance to the office portion, on Adams Street, is through a more business-like portal.

The first story is built of rock-faced granite, of a reddish hue, laid up in large blocks in a heavy buttressed manner at the base, giving it an expression of great strength, while the color harmonizes pleasantly with the red, pressed brick used in the rest of the structure. A series of arcades on the Adams street facade, support the superstructure, the heavy elliptic arches being on massive columns with carved capitals and moulded octagon bases and highly polished red granite shafts. A marked feature of this elevation is the large central arch that spans the entrance to the court approaching the offices. This granite arch is 22 feet in diameter, supported on large rectangular columns, with carved caps and moulded bases and polished red granite shafts. The arch is enriched in its spandrels with bold terra cotta carvings, and provided with beautiful wrought iron gates. The court referred to extends open from the grade upward, running back at right angles to a depth of 80 feet from Adams street, and entirely open to the street, making a recess, as shown in the engraving, that in effect divides this elevation into two buildings, connected by the massive archway shown, and lending a very unique and picturesque effect to the building. In the court is located the grand stair-case and elevator system for the offices. Surmounting the granite and encircling the street front of the building, is a heavy moulded belt course, or impost moulding, from which starts the brick-work of the superstructure. The brick work is disposed in liberal masses, with broad windows. Terra-cotta is used for the string courses and projections, but to a limited degree. No stone is used above the granite story. The street corner of the building is accentuated by a circular bay, carrying with it the effect of a tower and conservatory up through the entire height from its massive granite base, and surmounted by an observatory.

Many of the more recent details and the illustrations herewith are from the columns of the *Western Manufacturer*.

The Mobility of the Brain.

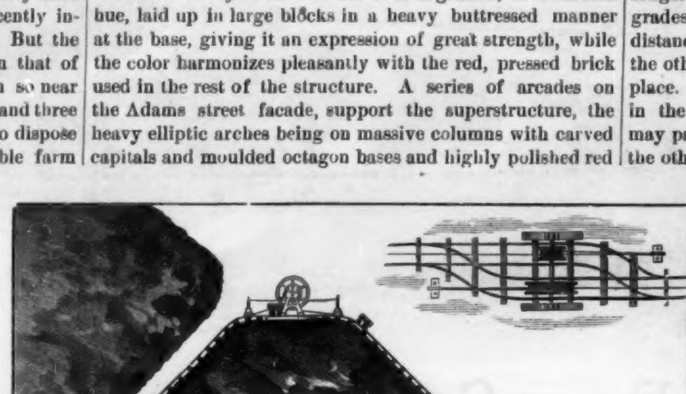
It has long been known that the brain in normal conditions undergoes certain rhythmical movements. The powerful vessels at its base cause the cerebral mass to rise and fall with each systole and diastole of the heart. The brain also rises slightly with each expiration and sinks with inspiration. These phenomena are dependent, it is presumed, upon the presence of the cerebro-spinal fluid, since when that is withdrawn the movements cease.

M. Luys, in a paper recently read before the Academie de Medecine, states that the brain is subject to still other changes in position, dependent upon the attitude of the body. If a man is in the dorsal decubitus, or lies upon his side, or stands upon his head, the brain undergoes certain corresponding changes in position in obedience to the laws of gravity. The movements take place slowly, and the brain is five or six minutes in returning to its first position.

From these anatomical data M. Luys deduces some striking conclusions of practical interest. He explains, upon the theory of these gravitating movements, the symptoms of vertigo and faintness which feeble persons experience when suddenly rising from a horizontal position. He asks if the pains of meningitis are not due to an interference with these normal movements. In cases of insanity he calls attention to the excitability and agitation which often come on when the patient lies down at night. As a practical point in mental hygiene, M. Luys advised against prolonged travel during most of the day, and urged the value of giving the brain the change produced by a horizontal position at night.—*The Medical Record.*

NEW ORE ELEVATOR.

The device shown in the engraving can be used to raise ore and waste from a mine whenever the outside grade is longer than the mine grade. On the level at the top of the grades are two rail tracks, placed side by side for a short distance, one of which extends down the mine shaft and the other down the side of the mountain to the dumping place. These tracks are connected by switches, as shown in the plan view, in order that the loaded and empty cars may pass each other and be transferred from one track to the other. Over the middle of the double track section is a shaft—placed at an elevation sufficient to allow cars to pass beneath it—carrying two drums, around the larger of which is a rope leading down the mountain, and around the other a rope leading into the mine. These drums are so proportioned that the time necessary for the two sets of cars to make the journey will be the same.



HARTT'S NEW ORE ELEVATOR.

In operating the device three or more ore cars and one dead-weight car are used. A loaded car passing down the mountain side will be able to raise both a loaded car and the dead-weight car from the mine, because of the greater leverage of the large drum around which its rope winds. After the car has discharged its load it is drawn to the top by the weighted car and an empty car descending to the mine, the combined weight of these two being sufficient to overcome the leverage. The large drum is provided with a groove, to receive a friction strap by which the speed of the cars can be regulated. It will be seen that this method utilizes the gravity of the material on a descending grade of greater length than the one up which the material has to be raised. By this plan all the work of raising the material from the mine and returning the empty cars is done by gravity; the expense is reduced to a minimum, the work is rapidly done and completely controlled.

This invention has been patented by Mr. W. A. Hartt, 99 Lake Avenue, Rochester, N. Y.

THE album of the Bank of England in which specimens of counterfeits are preserved has three notes which passed through the Chicago fire. Though they are burnt to a crisp, black ash, the paper is scarcely broken, and the engraving is as clear as new.

TO THE RESCUE OF LIEUT. GREELY.

For several weeks past the Brooklyn Navy Yard has been the scene of unusual and bustling activity, attracting visitors from all parts of the country. This kind interest centered in three staunch ships which will have started, ere this reaches our readers, on a long and perilous journey to the Arctic regions. Fitted with all the care and skill of modern marine engineering, provided with every known device for the comfort and safety of their crews, and guided by men who have voluntarily offered their services and risked their lives, these vessels are sent to the rescue of a small band of men who have been imprisoned in the ice for nearly three long years.

The direct result of a suggestion of the late Lieut. Karl Weyprecht was the establishment of a number of circumpolar stations for the purpose of scientific observation and practical exploration. At an International Polar Conference held in 1879 at Hamburg, the proposition was discussed in all its bearings, and the conclusion reached was that the best results would accrue from the placing of such stations. At a meeting held in St. Petersburg in 1881, the following stations were resolved upon:

The United States in Lady Franklin Bay, in Smith's Sound, and also at Point Barrow; Denmark at Godthaab; Germany in Cumberland Sound, on the western side of Davis Strait; England at Fort-Rae, in the heart of the Hudson's Bay territory, near the Great Slave Lake; Russia at the mouth of the Lena and at Moller's Bay, Nova Zembla; Holland at Dickson's Havn; Norway at Bosekop, in the Alten Fjord; Sweden at Spitzbergen; Austria at Jan Mayen Island, famous for its fog and ice. The Finnish Landtag equipped a meteorological station at Sodankyla; a branch station was also established in Labrador. France selected a station near Cape Horn, and Germany also ventured into the Antartic regions by sending a party to one of the islands of South Georgia, in 54 degrees south latitude and about 1,100 miles to the eastward of Cape Horn. Those in charge of the observatories at Melbourne and Cape Town were instructed to make a series of observations in connection with the French and German expeditions. Fifteen expeditions were thus arranged for to carry out the plans of the Commission. Arrangements were also made for taking magnetic and meteorological observations at several permanent observatories on the first and fifteenth of each month. The accompanying map shows the stations established in the Arctic circle. With the exception of the Danish, stations were established in accordance with the plans.

Reports from the Finnish station at Sodankyla were rich in scientific material. Experiments on a gigantic scale were made with the aurora borealis, and by an arrangement of batteries and wires along the face and up to the summit of a hill 1,000 feet high an artificial aurora was produced which differed in neither appearance nor spectroscopic analysis from the natural article. A photograph could not be obtained even with the most sensitive dry plate. The Austrian polar expedition, which returned last August from Jan Mayen Land after an absence of 16 months, was quite successful; the collection was rich, photographs numerous, and observations perfect. The English station at Fort Rae did good work, especially in spectroscopic observations. Good results have been obtained from the Swedish station at Spitzbergen. The operations of the Danish expedition were delayed a year, as the vessel was caught in the ice.

The station at Point Barrow, on the northern coast of Alaska, was in command of Lieut. P. H. Rae, who, together with his party, spent two years in scientific work. Having completed their building, the meteorological instruments were placed, and hourly observations were begun. The season being much advanced, the members of the expedition devoted much of their time to collecting botanical and zoological specimens. The magnetic work was very trying during the winter, as delicate instruments had to be manipulated and read in temperatures as low as 45 degrees below zero. Over 90,000 readings were taken and recorded from December 1, 1881, to August 1, 1882. Meteorological work was done at the same time.

On the 7th of July, 1881, Lieut. A. W. Greely, with twenty-three companions, left St. Johns, N. F., bound for his station on Lady Franklin Bay. The Proteus left the party on the 18th of the following August, since which time nothing definite has been heard from them. Lieut. Greely's orders were to make scientific observations, and in addition to explore as large an area of the polar region as he should find practicable. It was arranged that in the fall of 1883 a relief ship would be sent for him, and, consequently, two ships, the Proteus and Yantic, were dispatched. But the advance ship—Proteus—was nipped in the ice and crushed, her officers and crew narrowly escaping death.

These events, so briefly enumerated, have led to the fitting out of the present relief expedition.

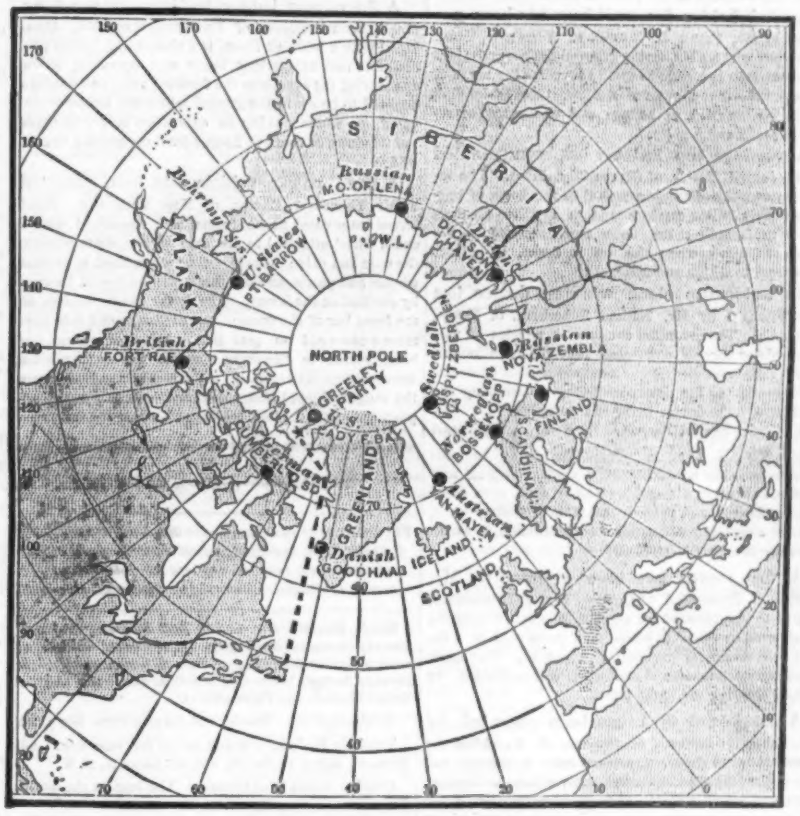
The Thetis, the flagship of the expedition, was a Dundee steam whaler, is of great strength and admirably adapted for the undertaking. She is of about 600 tons burden, 181 feet long, 29 feet beam, depth of hold 21 feet. Her engines are of 98 nominal horse power, and under favorable conditions can steam 6 or 8 knots an hour. Since her arrival new decks have been put in, and extra diagonal and athwart ship braces have been added. The detail of officers for the Thetis is as follows:

Commander W. S. Schley, commander; Lieutenant Uriel Sebree, executive; Lieutenant E. H. Taunt, navigator; Lieutenant O. C. Lemly, Ensign C. H. Harlow, Passed Assistant Surgeon E. H. Green, and Chief Engineer George W. Melville.

The steam sealer Bear was built at Dundee some nine years ago. A year since she was furnished with a new steel boiler, and her engines, of 110 horse power, are in good condition. She is of 548 tons burden, heavily timbered and strongly bolted.

The detail for the Bear is as follows: Lieutenant W. H. Emory, commander; Lieutenant J. H. Crosby, executive; Lieutenant John R. Colwell, navigator; Lieutenant N. R. Usher, Ensign L. K. Reynolds; Passed Assistant Surgeon H. E. Ames, and Chief Engineer John Lowe.

The Alert, the gift of the English Government, gained fame as the advance ship of the Nares expedition of 1875. She was built in the Pembroke dock yard in 1856. She is a double skin wooden vessel of 1,270 tons displacement and 381 horse power. She is classed as one of the strongest vessels afloat, and is therefore well suited for the arduous task on which she will be employed. At the time of writing, the detail for the Alert had not been completed.



CIRCUMPOLAR STATIONS.

The steam launches, one for each vessel, are provided with a combination joint on the screw shaft in order to raise the screw from the water in case of damage from ice. The condenser for making fresh water for drinking purposes and for supplying the boilers is a pipe running along the bottom of the boat parallel with the keel. Each of the vessels will have five small boats, two 28 feet long and three 24 feet long. Side keels are bolted under the bilges of each boat, to serve as runners when the boats have to be transported over the ice. The sleds are double enders, and, before loading, either side will serve as the top side. They are made of bent hickory, iron shod, and are probably the best that can be made for the purpose. They are about 10 feet long, 1 foot high, and 2¼ feet wide. Quantities of clothing and provisions have been stored on board. Each vessel will carry 2,000 gun cotton cartridges, which will be used to open a harbor for the ship in the ice if it should become necessary.

The expedition is commanded by Commander W. S. Schley. It is proposed to run all reasonable risks in order to save the explorers or to ascertain what has become of them. Its progress will be watched with absorbing interest by the civilized world, and its success devoutly hoped for.

Saturn.

Maupertuis thought that Saturn's ring was a comet's tail cut off by the attraction of the planet as it passed, and compelled to circle round it thenceforth and for ever. Buffon thought the ring was the equatorial region of the planet, which had been thrown off and left revolving while the globe to which it had belonged contracted to its present size. Other theories also went upon the assumption that the rings are solid. But if they are solid, how is it that they exhibit traces of varying division and reunion, and what are we to think of certain mottled or dusky stripes concentric with the rings, which stripes, appearing to indicate that the ring where they occur is semi-transparent, also are not permanent? Then, again, what are we to think of the growth within the last seventy years of the transparent dark ring, which does not, as even air would, refract the image of that which is seen through it, and that is becoming more opaque every year? Then, again, how is it that the immense width of the rings has been steadily increasing by the approach of their inner edge to the body of the planet? The bright ring once twenty-three thousand miles wide was five thousand miles wider in Herschel's time, and has now a width of twenty-eight thousand three hundred on a surface of more than twelve thousand millions of square miles, while the thickness is only a hundred miles or less. In 1857 Mr. J. Clerk Maxwell obtained the Adams prize of the University of Cambridge for an essay upon Saturn's rings, which showed that if they were solid there would be necessary to stability an appearance altogether different from that of the actual system. But if not solid are they fluid, are they a great isolated ocean poised in the Saturnian mid air? If there were such an ocean, it is shown that it would be exposed to influences forming waves that would be broken up into fluid satellites.

But possibly the rings are formed of flights of disconnected satellites, so small and so closely packed that, at the immense distance to which Saturn is removed, they appear to form a continuous mass, while the dark inner mass may have been recently formed of satellites drawn by disturbing attractions or collisions out of the bright outer ring, and so thinly scattered that they give to us only a sense of darkness without obscuring, and of course without refracting, the surface before which they spin. This is, in our guide's opinion, the true solution of the problem, and to the bulging of Saturn's equator, which determines the line of superior attraction, he ascribes the thinness of the system of satellites in which each is compelled to travel near the plane of the great planet's equator.

Whatever be the truth about these vast provisions for the wants of Saturn, surely there must be living inhabitants there to whose needs they are wisely adapted. Travel among the other planets would have its inconveniences to us of the earth. Light walking as it might be across the fields of ether, we should have half our weight given to us again in Mars or Mercury, while in Jupiter our weight would be doubled, and we should drag our limbs with pain. In Saturn, owing to the compression of the vast, light globe and its rapid rotation, a man who weighs twelve stone at the equator weighs fourteen stone at the pole. Though vast in size, the density of the planet is small, for which reason we should not find ourselves very much heavier by change of ground from earth to Saturn. We should be cold, for Saturn gets only a ninetieth part of the earth's allowance of light and heat. But then there is no lack of blanket in the house of Saturn, for there is a thick atmosphere to keep the warmth in the old gentleman's body and to lengthen the Saturnian twilights. As for the abatement of light, we know how much light yet remains to us when less than a ninetieth part of the sun escapes eclipse. We see in its brightness, as a star, though a pale one, the reflection of the sunshine Saturn gets, which, if but a ninetieth part of our share, yet leaves the sun of Saturn able to give five hundred and sixty times more light than our own brightest moonshine. And then what long summers! The day in Saturn is only ten and a half hours long, so that the nights are short, and there are twenty-four thousand six hundred and eighteen and a half of its own days to the Saturnian year. But the long winters! And the Saturnian winter has its gloom increased by eclipses of the sun's light by the rings. At Saturn's equator these eclipses occur near the equinoxes and last but a little while, but in the regions corresponding to our temperate zone they are of long duration. Apart from eclipses the rings lighten for Saturn the short summer nights, and lie, perhaps, as a halo under the sun during the short winter days.—*Knowledge.*

A Great Improvement for Little Money.

The proposed further dredging of Newtown Creek, L. I., is one of those "river and harbor improvements" which cannot cost more than a small sum at the furthest, and will be of great benefit to a large population, an immense industry, and extended commercial interests. Newtown Creek is a sluggish channel on the eastern outskirts of Brooklyn, entering the East River opposite the central part of New York city, and on its banks are many large manufacturing and commercial establishments, the capital invested in the various industries probably exceeding $20,000,000. The trade in refined oils centering in that locality amounts to $10,000,000 dollars annually. Slight amounts have been expended on widening and deepening the channel since 1880, and it is now proposed to make it 200 feet wide and 18 to 21 feet deep at the mouth.

ENGINEERING INVENTIONS.

An improved car coupling has been patented by Mr. Charles W. Spencer, of Richmond, Mo. The invention covers a double hook or anchor-shaped link, with a balance weight, and means for raising or lowering it to disconnect it from another, making a simple means for coupling or uncoupling by men on the cars or on the ground.

A car truck has been patented by Messrs. James H. McClure and George F. Murdock, of Wellsville, O. This invention provides means whereby cars of reasonable length may be mounted on three trucks each, and the central truck be enabled to follow curved tracks, so the length of a car may be doubled at only a small additional expense.

A car replacer has been patented by Mr. Joseph A. Hodel, of Cumberland, Md. This is for replacing on the track cars which have been derailed, and provides means for guiding the wheels while the car is moved, and means whereby the same device is adapted to be used in connection with rails of different heights, and so a portion of the device may be forced through the ground beneath the rail.

MECHANICAL INVENTIONS.

A valve grinder has been patented by Mr. Harry W. Burleigh, of Franklin, N. H. The invention comprises improved clamps, centering devices, revolving gear, and coupling mechanism, making simple and efficient means for readily grinding globe and similar valves, and refitting them without disconnecting them from the pipes with which they are in use.

A circular sawing machine has been patented by Mr. John Van Patten, of East Tawas, Mich. This invention provides means whereby two ends of a piece of lumber may be sawed off in succession, means whereby the said frames may be adjusted to align the saws, different saw frames held up while their saws are at work, and so the throwing up of one frame will cause the others to fall, and generally improving sawing machines where two or more saws are used.

AGRICULTURAL INVENTIONS.

A check row corn planter has been patented by Mr. Thomas J. Lindsay, of Lafayette, Ind. The invention covers a special combination and arrangement of parts to secure accuracy in check row corn planting, and promote convenience in controlling the planters.

A cotton planter has been patented by Mr. William T. Gardner, of Tarborough, N. C. The invention covers a special construction and arrangement, whereby the spout slightly spreads the seeds, so the plants can be more readily thinned than when the seed is deposited in the ground in bunches, the seed is covered with soil, and the top of the ridge is smoothed off by a covering block.

A corn planter has been patented by Mr. Hiram D. Layman, of Benton, Ark. This invention relates to wheeled corn planters having rotary dropping devices, and the wheels are so made adjustable on their axles by means of feathers that they may be set to act as guides in laying off rows of any desired distance apart. A seed sower has also been patented by the same inventor, the patent covering a novel construction in that class of devices where a perforated rotary cylinder is employed for distributing the seeds over the ground. A cotton planter forms another subject of a patent issued to the same inventor, the frame being combined with a series of plows arranged to throw up a ridge and open a furrow therein, in connection with which is operated a cylindrical seed drum with a series of uniform holes, with various special devices connected therewith. A cotton chopper has also been patented by Mr. Layman. This invention covers a novel construction in which the hoes are made readily removable, so that any desired number may be employed, according to the "stand" of cotton required, and there is a device for elevating the chopper, to hold the plows and wheels out of contact with the ground when desired.

MISCELLANEOUS INVENTIONS.

An improved trunk has been patented by Mr. William J. Large, of Brooklyn, N. Y. The invention consists principally in the direct pivoting of the tray to the lid and connecting it pivotally to the body, with various subsidiary parts.

An odorless privy seat or chair has been patented by Mr. Franklin B. Kendall, of Tumwater, W. Ter. This invention is an improvement on a former patent issued to the same inventor, covering improvements in the construction and arrangement of parts.

A process of making zinc sulphide anhydrous has been patented by Mr. Thomas Macfarlane, of Montreal, Canada. The invention consists in mingling zinc chloride with hydrated zinc sulphide, to exclude air while it is being ignited or rendered anhydrous and converted into a valuable pigment.

An improved pencil has been patented by Mr. George C. Ward, of Girard, Kansas. The invention relates to automatic pencils, in which the lead or crayon is projected by pressure on the rear end of a spring tube, and provides therefor an improved construction and combination of parts.

A buck saw frame has been patented by Mr. Theophilus Larouche, of Williamstown, N. Y. This invention covers a special arrangement and combination of parts, whereby a buck saw frame is made firm and easily adjustable, and will not fall apart when loosened up for removing or replacing the saw blade.

An engraver's bangle clamp has been patented by Mr. Henry Carpenter, of Flushing, N. Y. It is made of a tapered and slotted block, with recessed clamping plates at its upper end, and with a tapered and slotted band working on guide pins for drawing the parts of the clamp together, and a spring for separating them.

A toy to be used with fire crackers has been patented by Mr. Charles Diener, of New York city. A miniature house is so made, and provided with various images, that the explosion of a fire cracker therein will force the images into position for observation at various openings, such as at the top of the chimney and at the doors and windows.

An apparatus for stereotyping has been patented by Mr. Frederick J. Smith, of Brooklyn, N. Y. In combination with a novel which has its forward end slotted is a foot piece with its forward side notched and removable side bars engaging therewith, with other peculiarities of arrangement and construction to adapt the apparatus to a wide variety of work.

A mail bag has been patented by Mr. John S. Bailey, of Buckingham, Pa. In combination with the jointed frame of a mail bag is a shield plate attached to one of the center joints of the frame, with fingers on its inner face for bracing the frame and holding the labels, with which is connected a suitable hasp, with other peculiarities of arrangement and construction.

An elevator for seed cotton and other materials has been patented by Mr. Sidney W. Bartholomew, of Castalia, N. C. In combination with a hopper having grooves is an adjustable feed board with ribs, so the quantity of seed cotton or other material drawn up the flue can be regulated to prevent clogging of the machine.

A wagon brake has been patented by Messrs. James Hocking and Clement R. Jones, of Denton, Neb. The invention relates to wagon brakes which are automatically applied by the back thrust of the team, and consists in the special construction and arrangement of devices in a single horse vehicle for accomplishing this result.

A washing machine has been patented by Mr. Francis G. Powers, of Champaign, Ill. The invention covers an improved construction for securing a better connection between the pounder stem and its operating handle, and means for making a better joint between the pounder stem and the cover, as well as an improvement in the pounder itself.

A label holder for mail bags has been patented by Mr. Frank L. Herold, of Terryville, Conn. Combined with a strip having grooved flanges and a longitudinal slot is a slide adapted to receive the tag, and to pass it under the grooved flanges, thereby holding the tag on the strip, so the tags can be inserted or removed easily and rapidly.

A carriage top fastener has been patented by Mr. John J. Travis, of Carson City, Mich. The invention consists of straps attached to the bows of buggy and other falling carriage tops in a novel manner, for use in fastening the bows together, and to the braces of the top when the top is down, to protect them from breaking and wear, etc.

An automatic clock winding device has been patented by Mr. Nathan Silberberg, of Yassy, Roumania. The invention consists in a series of metallic rods or bars so connected that the variations in their length from changes in temperature can be utilized for producing the power necessary to wind up the clock works, the device being self-operating.

A churn cover fastener has been patented by Mr. Mark M. Maycock, of Buffalo, N. Y. In combination with the head, having a central opening and staples, is a cover with guides and a disk, with overlapping flanges, and handles and radially sliding bolts, making a specially advantageous construction, in which the wear is evenly distributed.

A fire escape has been patented by Mr. Reuben C. Rutherford, of Quincy, Ill. This invention relates to that class of fire escapes in which a metallic band, wire, or cable is wound on a drum held in a device with means for suspending a person. The apparatus can be stopped and started at will as desired, by simply pressing the brake levers.

An improved shirt has been patented by Mr. John H. Scriven, of Grafton, N. Y. After the bosom is cut to shape, a perfect hem is formed and stitched on the margin thereof, after which the hemmed portion is joined with the body or main portion of the shirt, so as to give the same appearance to the bosom as if separate binding strips were used.

An automatic incline pool ball rack and spotter has been patented by Mr. William A. Tea, of Clyde, O. The invention consists in providing a place for keeping a given number of pool balls, which can be placed on the table when desired, and spotted or bunched by simply moving the conductor or tube until it strikes the table, when the balls pass down an incline into the slotted tube.

An improved tongs for lifting spools of fence wire has been patented by Mr. William A. Hardin, of Leavenworth, Kansas. The invention consists of two bent levers pivoted together, with two of their ends adapted to lie close together, so they may be inserted in a central opening of a spool, and then spread apart to cause them to bind, by the act of lifting one or both the levers.

An apparatus for agitating the liquor in tan vats has been patented by Mr. Thomas A. Mayes, of Phillipsburg, Pa. In combination with a vat are boxes or compartments on the bottom with pipes and valves so connected therewith that fresh lime can be mixed with the liquid in the vats without requiring the skins to be removed, and they can be limed more rapidly than in the ordinary vats.

A stove jacket has been patented by Mr. William H. Benson, of Elston, Mo. It fits over the stove and connects with the draught flue, and has a heating closet within and supported by the jacket to inclose the stove top, the closet and jacket having independent connections with the draught flue, all to confine the heat radiated from the stove, and keep the apartment cool when desired.

A buoyant propeller for vessels has been patented by Mr. Nicolai Petersen, of Charleston, S. C. This invention provides wheels which will float themselves and a superposed load, the wheels at the same time serving as propellers; a deck or cabin is so mounted on the wheels that one or more of them may be turned for steering the boat, and all are connected with one driving power.

A shutter worker has been patented by Mr. Leonard Tilton, of Brooklyn, N. Y. The invention consists principally of a jointed arm adapted to be attached to the blind, and to a stud fastened on the window sill, the arm and stud having means for locking the arm and its sections at any desired position for holding the blind open or closed or at any intermediate position.

An improved coupling for ropes or cables has been patented by Mr. George M. Green, of Streator, Ill. A socket with two longitudinal grooves in the sides of its aperture and two notches at the inner end, has a key fitting in the aperture, with two opposite projections on the inner end, the socket having a loop or frame in which is a spring, thus making an easily operated coupling for ropes or cables.

Improvements in blocks for building purposes form the subject of a patent issued to Mr. Thomas L. Jowett, of Boston, Mass. The invention covers, in a wall, floor, or other like structure, the combination of a series of slab like blocks, with longitudinal tongues and shoulders on opposite sides, with which buildings may be constructed cheaply, made fireproof, free from damp, and of a solid and neat external appearance.

A butter package has been patented by Mr. John C. Brown, of Davenport Center, N. Y. The cover has an annular ridge, with a series of diametrically opposite notches, ears projecting from a ring surrounding the jar, cam levers held to turn on the ears, and a cross piece pivoted in the cam levers, the whole making a package which may be sealed air tight, with a handle forming part of the fastening.

A combined platform rocker and reclining chair has been patented by Mr. Peter B. Cupp, of Van Wert, Ohio. The seat frame has side grooves and arms with closed slots, the sliding seat has a rack with hinged back having studs projecting laterally into the slots, and there is a rotatable pinion shaft with a squared end, with other improved details of construction for adjusting the seat and limiting its movements.

A fire escape ladder has been patented by Mr. William Brannan, of Fredericksburg, Va. Combined with a wheeled frame is a sheath and ladder pivoted to a rear axle, a lazy tongs and operating screw connecting the sheath to the forward axle, and anchors adapted to be set in the ground when the ladder is elevated, the whole making an extensible ladder to reach the windows or roofs of houses from the ground in case of fire.

A hand power vehicle has been patented by Mr. Thomas A. Davies, of New York city. Hand levers are pivoted to the frame and connected with a chain wheel attached to the axle of the drive wheels, the axle and drive wheels being connected by ratchet wheels and pawls, so the vehicle will be forced forward by oscillating the levers. The driver rests his feet on the front bar of the frame, but to turn to one side operates a cross rod on that side. A further patent has been issued to the same inventor for an invention whose object is to simplify the construction and lessen the weight of hand power vehicles, secure a direct application of the driving power, and lessen the friction.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) W. B. A. writes: I have some lard that is old and strong; is there any way to get the strong taste out, or any cheap way to get it into an oil for a lubricator? A. The following is given as an excellent method for trying out the lard: Set a large kettle over a fire in some sheltered place, out of doors, on a still day. It will cook much quicker in large quantities. Put into the kettle, while the lard is cold, a little saleratus, say one tablespoonful to every twenty pounds; stir almost constantly when nearly done, till the scraps are brown or crisp, or until the steam ceases to rise, then there is no danger of its moulding; strain out into pans, and the first will be ready to empty into crocks when the last is strained. To one cake of lard 2¼ pounds; camphor, 1 ounce; black lead, ¼ pound; rub the camphor in a mortar, down into a paste, with a little of the lard; then add the rest of the lard and the black lead, and mix thoroughly for a satisfactory anti-attrition paste.

(2) J. A., of St. Petersburg.—Steer's opodeldoc is as follows: White Castile soap, cut small, 2 pounds; camphor, 5 ounces; oil of rosemary, 1 ounce; oil of origanum, 2 ounces; rectified spirit, 1 gallon; dissolve in a corked bottle by the heat of a water bath; and when quite cool, strain, then add ammonium hydroxide (aqua ammonia), 11 ounces; immediately put it in bottles, cork close, and tie over with bladder. It will be very fine, solid, and transparent when cold.

The liquid opodeldoc is prepared by taking 2 ounces Castile soap shavings, and dissolving them in one quart alcohol, with gentle heat, then add 1 ounce camphor, ½ ounce oil rosemary, and 2 ounces spirits hartshorn (aqua ammonia). For cure of rheumatism, we advise consultation with physician. It is impossible to recommend any prescription without first seeing the patient.

(3) G. A. S. asks what he can use to remove varnish and paint from wood. A. We would recommend you to use a solution of caustic soda. It is applied with a brush made of bristles, and after a while is rinsed off with water. This operation is repeated several times, according to the thickness of the paint. Some caution is necessary to prevent the wood checking. By this means the wood is restored to its natural color.

(4) H. C. asks for any apparatus or dialyzer by which alkali and silica in solution (solution of silicate of soda) can be separated in large quantities, retaining the alkali in solution in one vessel and the silica in solution in another. A. We do not remember any mechanical apparatus by which the silica can be separated from the waterglass. Chemically, however, that is, by the addition of alkaline carbonates or chlorides, the silica will be thrown down.

(5) M. M. W.—On page 2499 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, several recipes for indestructible inks are given, either of which will probably meet your demands. The majority of inks contain glycerine, the tendency of which is to prevent their perfect drying, and hence the blurring to which you allude.

(6) G. K. G. asks: What will remove red ink from a ledger without defacing the writing? A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, recommends cold aqueous or acetic acid solution of calcium hypochlorite, bleaching powder, or eau de javelle; in fact, any bleaching agent ought to accomplish the object.

(7) B. S. H. asks for preparation by which steam laundries make their goods so stiff and give such a glaze to them, especially collars and cuffs? A. This is given in full in answer 3, in SCIENTIFIC AMERICAN of May 26, 1883. 2. Please give formula for good cologne. A. Take of pure 95 per cent cologne spirits 6 gallons, oil of neroli 4 ounces, oil of rosemary 2 ounces, oil of orange 5 ounces, oil of citron 5 ounces, oil of bergamot 2 ounces; agitate; then allow to stand for a few days perfectly quiet before bottling. 3. What is the use of gold chloride in photography; otherwise, what good does toning do a picture, and what is it for? A. Gold chloride is used to tone the picture, that is, to soften the harsh effects produced by the direct action of the sun.

(8) C. A. B. writes: I am desirous of becoming a mechanical engineer, and having mastered mathematics through calculus, would like to know what books would be required? A. We give the names of some of the works studied in our schools of technology, but we think you would find it very difficult to master them without supplementary instruction: Elementary Mechanics, by De Volson Wood. The Materials of Engineering, 2 vols., R. H. Thurston. Mechanics of Engineering, J. Weisbach. Machinery and Millwork, Steam Engine and other Prime Movers, by J. W. McQ. Rankine. Roofs and Bridges, De V. Wood. Civil Engineering, Wheeler. Metallurgy, "*Science Series*," Bloxam. Elements of Machine Design, Unwin. Steam Engine, Proportion of. W. D. Marks. Elementary Quantitative Analysis, Elliot & Storer. Elementary Qualitative Analysis, Thorpe. Steam Engine, Arthur Rigg. Catechism of the Locomotive, Forney. Haswell, Engineer's Pocketbook. Molesworth, Engineer's Pocketbook. Trautwine, C. E. Pocketbook. Ganot's Physics, Atkinson.

(9) J. B. F. asks: 1. Ought steam pipes to leak at all if properly put up and the valves kept constantly packed and in good order? A. No. 2. Could the turning of steam on to a line of pipes when the return valve is closed start a leak or burst the pipes? A. It should not.

(10) M. & Co. ask what are the best proportions of tin, antimony, and copper for genuine Babbitt metal. Are the different proportions of these metals used according to the different speeds required? A. Genuine Babbitt metal, according to the formula of the inventor, is 9 of tin and 1 of copper. Antimony has been added since, so that the proportions by hundreds will stand 80 tin, 5 copper, 15 antimony. For high speeds the metals should be cooler, giving a larger proportion of tin; for weight the metal should be harder, giving a larger proportion of antimony.

(11) E. C. asks how to clarify or filter cod liver oil? A. Filter the oil through charcoal in a linen or felt filter.

(12) H. W. writes: The other day I accidentally got some quicksilver on a large gold ring, and am unable to remove it. A. We fear that the mercury has become amalgamated with the gold, in which case it will be necessary to treat the ring with chemical reagents. It is possible that you may remove some of the mercury by heating the ring as hot as possible without melting, thereby causing the mercury to volatilize.

(13) J. W. S. writes: 1. A mischievous boy has daubed my blackboard with candle grease. It does not wash off with soap or soda. What solvent would you recommend? A. If the candle is made of paraffine, hot oil of turpentine will dissolve it. Ether will also be found to be a good solvent. 2. How may I make an automatic blow pipe to use in blowing glass? I cannot blow the flame and glass too. A. Connect the end of the blow pipe with bellows by means of rubber tubing.

(14) A. G. W. asks if there is any preparation for making the hair white without injuring the hair or scalp? A. Peroxide of hydrogen will take the coloring material entirely out of hair. See description of this important bleaching agent in SCIENTIFIC AMERICAN SUPPLEMENT, No. 339. No injury attends its employment.

(15) E. B. S. asks the horse power of an engine as follows, viz.: Diameter of cylinder, 9 in.; length of stroke, 12 in.; revolutions per minute, 150; pressure of steam (in boiler), 60 pounds; cut off at 9 in.; mean effective pressure, 58 pounds? A. About twenty-five horse power. 2. The means by which the power is obtained? A. See rule in SUPPLEMENT, No. 253.

(16) J. R. D. asks: What lacquer is used by makers of chandeliers that makes them look so bright and like red brass? A. Take two gallons spirits of wine, one pound dragon's blood, three pounds Spanish annatto, four and a half pounds gum sandarac, two pints turpentine. Digest for a week, shake frequently, decant, and filter.

(17) P. & Co. ask: What are the compositions used in making the slip for the inside of pipkins? A. The following is a white glaze suitable for earthen ware. An intimate mixture of massicot, 4 parts; tin ashes, 2 parts; crystal glass fragments, 3 parts; and ½ part sea salt. This mixture is melted, and the liquid flux used.

(18) W. L. C. asks for a formula for correcting the taste of rancid butter? A. The rancidity is due to butyric acid, a substance freely soluble in water or fresh milk, so that the butter can be thoroughly washed, first with good new milk and then with cold spring water; or the butter can be melted in water, which will dissolve out the butyric acid, and then work it over.

(19) J. F. writes: I have some wrought iron bars which I wish to nickel plate, but from some cause unknown to me I have been unable to plate them so as to keep bright in the open air. How shall I remedy this? A. The difficulty is due to the oxidation of the iron, the adhesion of the nickel not being as satisfactory as if the iron were first copper plated and then coated with nickel; or even better still would be to first coat the iron with copper, then tin, and finally with nickel.

(20) L. S. asks (1) the best and cheapest way to construct a furnace for melting brass and cast iron for casting small articles. A. You may melt 5 pounds of brass or cast iron in a forge by building a small well of fire bricks around the tuyere, about 16 inches high, 12 inches diameter, and melt in a crucible with a charcoal fire; put a large piece of charcoal over the crucible to keep the heat in. 2. Do you think it at all probable that bills now pending, as regards patents, will become laws? A. Time alone can divulge what action our erratic Congress may take as regards the patent laws. 3. Do you think the new form of steel mentioned in SCIENTIFIC AMERICAN of 8th ult., page 151, column three, will soon be introduced in United States? A. We have had inquiries concerning the steel castings you mentioned from our own manufacturers, and we presume that experiments in that line are already being made in this country. If the new steel is found upon trial to be useful for its price, it will no doubt be largely used.

(21) W. W. asks: 1. Why is it that the rule for finding the traction of locomotives only takes note of one cylinder? A. We have seen no rule that takes note of but one cylinder; if you can refer to such a rule, perhaps we shall be able to explain it. 2. What is the cause of water flowing in gushes from an underground flume? Would several different angles of inclination cause it? A. Could not say without examination. Very likely, because of commingling with the current. 3. If the velocity of water falling free from a height of 16 ft. is about 32 ft. per second, what would be the velocity at the small end of a properly constructed cone under the same head of water? A. The velocity will be less under the conditions you name, but we cannot tell exactly how much, since you do not state explicitly all the aspects of the problem.

(22) R. C. asks best receipt for cleaning spots or stains from his English tile. A. This depends upon the nature of the stain forming the spot. Naturally they must be removed by some solvent which will dissolve them without affecting the tile. Water, alcohol, ammonia, caustic alkalies, and even acids will hardly have any effect upon the porcelain surface of tiles.

(23) B. S. H.—Of course trotting at a high rate of speed is an artificial gait for a horse, but we believe that trotting is the natural intermediate gait between walking and cantering. There is nothing in the anatomy of the horse that renders trotting unnatural or awkward. The yearling at the side of its dam takes as naturally to trotting as it does to cantering.

(24) S. A. H. writes: I should like to ask if salt in some form is not necessary to the maintenance of the human system. A. Salt (chloride of sodium) is believed to be necessary to the health of the human system. But probably no such extensive and habitual use of it as civilized people indulge in is essential. It is well known that the Maori, aborigines of New Zealand, a strong and hardy race, do not use salt.

(25) J. P. McD. asks: 1. What animal has the finest hearing, and its cause? A. Nothing is certainly known as to the absolute superiority of any species of animals in this respect. That many mammals possess a very keen sense of hearing, and detect sounds, inaudible to human ears, is unquestioned. The common cat in an alert state has a very sharp and accurate ear, also the barn owl. The bats have extremely sensitive auditory nerves, detecting the almost noiseless rush of insects through the air. Perhaps the best equipped animals with this sense are the group of foxes known as Feneks, or desert foxes, of Africa, of which *Canis zerdo*, the desert fox, is a typical example. It has large ears and nervous concentration when aroused. In regard to the cause, it may be generally said that the acuteness of a sense is conditioned largely upon its usefulness in the animal's economy. Hunting animals have necessarily a better sense of hearing than those whose prey is more easily obtained. Again *per contra*, timid, defenseless animals, as the hares, have trained ears because they subserve to them the purpose of protectors. Also the size of the external ear is a fair index of the provisions supplied in this sense for the animal. All animals, says Brehm, which have large, erect, and easily moved ears hear better than those whose auditory apparatus is small, dependent, and sluggish. 2. Is not perfection in nervous force and physical development more nearly attained in the tropics than elsewhere? A. This may be answered with some reservations, yes, though some definitions of nervous force might modify this considerably.

(26) A. G. asks: 1. How is gold lettering put on the backs of books, and what composition is used to make the gold leaf stick? A. Gold letters are printed or pressed on book bindings by means of an albuminous size—white of eggs—the gold leaf placed on the size and the block of type heated and pressed on the gold leaf. 2. How is gold printing done on cards and paper? A. Gold printing on paper is printing with a size sold as "gold size" and dusting with bronze powder.

(27) F. O. asks how to give brass the beautiful iridescent colors. A. By referring to the SCIENTIFIC AMERICAN of December 1, answer 14, the process of obtaining the iridescent colors will be found. The antique or very old brass color is probably the result of some lacquer whose composition is not generally known. The bright gold finish on brass is, if not the result of polishing, apt to be produced by some lacquer, such as the following: Seed lac, 3 ounces, turmeric 1 ounce, dragon's blood ¼ ounce, alcohol 1 pint. Digest for a week, frequently shaking, decant, and filter.

(28) L. P. V. asks if a refracting telescope can be rendered as perfectly free from chromatic and spherical aberration on the dialytic plan as by the common method where the crown and flint lenses are in contact, or nearly so? And, if so, why are not the larger astronomical telescopes so constructed, thus saving thousands of dollars in the cost of the flint lens, besides actually shortening the length of tube for a given focal distance? A. The dialytic telescope cannot be made as perfect as those corrected at the object glass. This is the reason they are but little known. The field is not as large, and the definition is only good in the center.

(29) M. E. E. asks for a recipe for making water colors, such as are used for coloring photographs. A. The articles referred to are presumably nothing but aniline colors. So that you can purchase the desired color or shade of aniline you desire, dissolve it in water or alcohol according as to which is the proper solvent, and you will have the color precisely identical to the variety possessing the fanciful name. 2. Can you tell me of any way in which tar can be rendered more palatable to the taste, when taken as a medicine? Macerate tar in eight times its weight of alcohol until completely dissolved, then add a suitable flavoring compound, such as oil of wintergreen.

(30) G. J. G. writes: If two ten horse power engines were running 100 revolutions per minute, one with 48 inch pulley on crank shaft driving on to a 24 inch pulley on counter shaft, the other with 24 inch pulley on crank shaft driving on to a 24 inch pulley on counter shaft, both using 4 inch belt and same distance from center to center of each shaft, which counter shaft will require the most amount of power to stop in the same length of time? A. One-half the power only applied in the second case to the counter shaft will be required in the first case.

(31) H. B. A. asks: Will oil spread over tubes in boiler after cleaning prevent its scaling? A. No, but for a short time it may prevent the scale adhering.

(32) A. McL., Jr., asks how litmus is thoroughly dissolved. A. The preparation of litmus is as follows: The ground lichens are first treated with urine containing a little potash, and allowed to ferment for several weeks, whereby they produce a purple red; the colored liquor, treated with quick lime and some more urine, is again set to ferment during two or three weeks; then it is mixed with chalk or gypsum into a paste which is formed into small cubical pieces by being pressed into brass moulds and dried in the shape. Litmus is easy to pulverize, is partially soluble in water and dilute alcohol, leaving a residue consisting of calcium carbonate, silica, gypsum, and iron oxide combined with the dye. This residue is not soluble unless by treatment with acids, which would interfere with the action of the litmus. For making litmus paper an infusion of one ounce of litmus to half a pint of hot water is recommended by Faraday.

(33) J. B. R. asks: 1. Is the pressure the same on the bottom of a boiler as on the top? If there is any difference, please tell me which has the greatest, and what is the difference? A. The greatest pressure is at the bottom, as you have there the weight of the water in addition to the pressure of steam. 2. How high will a good jet throw water with 100 pounds steam? A. We cannot say, as it depends on other things than merely the pressure, viz., length, kind and size of pipe, diameter and shape of nozzle. 3. How high will a siphon lift water or oil with one hundred feet fall? With two hundred feet fall? A. A siphon cannot lift water more than 30 or 28 feet, and even then there must not be any air leaks; we think not more than 18 or 20 feet can be depended upon in ordinary work. 4. When a locomotive is going down grade with her engines reversed for the purpose of holding back, where does she exhaust her steam? A. Whether going ahead or back, it must exhaust through the pipe to chimney.

(34) H. N. P. asks how the cement composed of equal parts of pitch, gutta percha, and shellac is made. A. Fuse together the gutta percha and the pitch, then add the shellac, or else dissolve the mixture in carbon disulphide.

(35) J. B. W. asks: How shall I mix wax and gutta percha? A. By dissolving them in coal tar, naphtha, carbon disulphide, or like solvents.

(36) J. M. asks how to make powdered manganese into blocks for Leclanche batteries. A. Manganese dioxide is mixed in nearly equal parts with carbon, but with the addition of a small quantity—5 per cent—of resin for the purpose of giving consistency to the mass. These three substances, properly pulverized and intimately mixed, are conglomerated under a considerable pressure, and at a temperature of 212° Fah., into a solid cylinder. A small cylinder of sodium bisulphate is also inserted in the center of the carbon and manganese electrode while it is being moulded.

(37) J. K. M.—The composition used for picture frame ornaments is elastic, for fitting to uneven surfaces while fresh, and dries hard. If for outside work they should be thoroughly oiled with linseed oil upon the backs when applied, using nails and no glue. This composition is made like putty and of the same material, only worked up hard and moulded with a press.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Mrs. B. W. A.—The specimen is an iron ore—hematite (sesquioxide of iron).

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April 15, 1884,

AND EACH BEARING THAT DATE.

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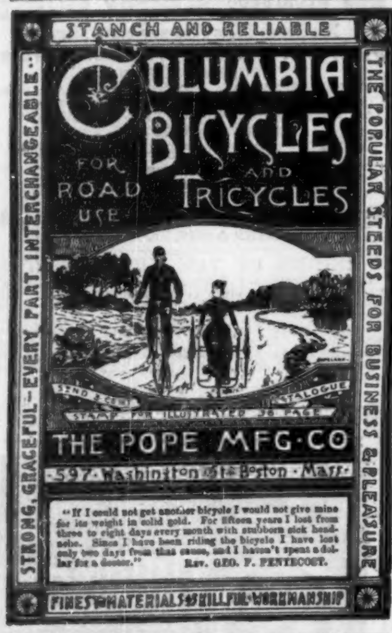

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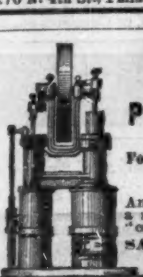

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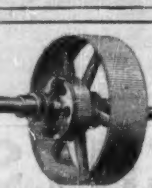

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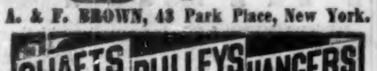

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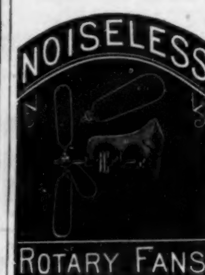

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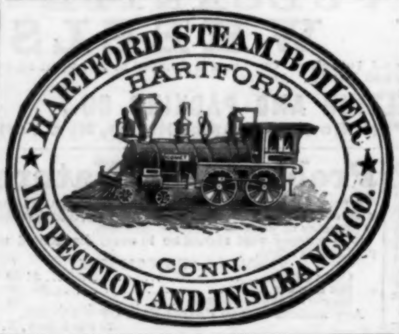

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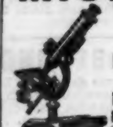

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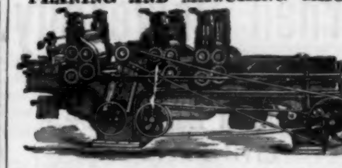

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